Climate Change Planning in Alaska's National Parks

Scenarios Network
FOR ALASKA & ARCTIC PLANNING

Central Alaska Parks
Webinar #2
April 11, 2012

Scenario Building

Overall Project Summary

- Changing climatic conditions are rapidly impacting environmental, social, and economic conditions in and around National Park System areas in Alaska.

- Alaska park managers need to better understand possible climate change trends in order to better manage Arctic, subarctic, and coastal ecosystems and human uses.

- NPS and the University of Alaska's Scenarios Network for Alaska Planning (UAF-SNAP) are collaborating on a three-year project that will help Alaska NPS managers, cooperating personnel, and key stakeholders to develop plausible climate change scenarios for all NPS areas in Alaska.

NPS photos

Webinar #2 Goals

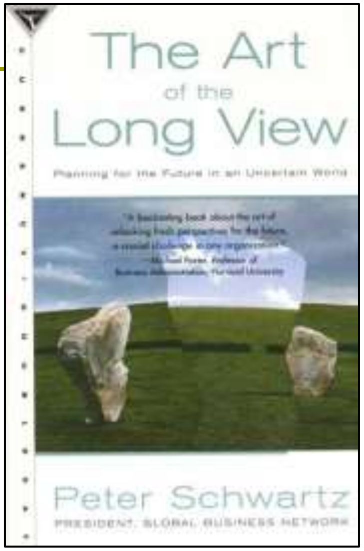
- Reminder of the role of climate drivers and climate effects in the scenarios planning process
- Overview of scenario drivers (critical uncertainties) for Interior Arctic parks
- Discussion of a drivers table
- Discussion of effects, with survey results

Readings (pt. 1)

- *The Art of the Long View, emphasis on first 4 pages (p. 3-6); User's Guide (p. 227-239); and Appendix (p. 241-248)*.

  These can all be read for free in the page previews on Amazon ("Click to Look Inside") at

  http://www.amazon.com/Art-Long-View-Planning-Uncertain/dp/0385267320

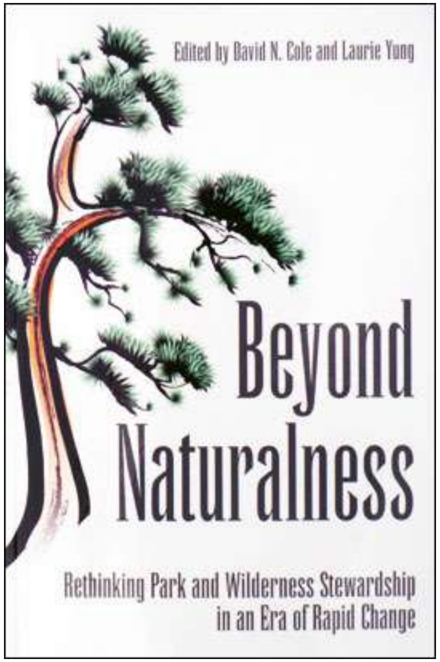


- SNAP one-page fact sheet *(Tools for Planners)* and link to website for optional browsing, plus detailed notes from the August and February meetings, online at

  http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/ARCN/

Readings (pt. 2)

- *Interior and Arctic Talking Points,* entire document online at *http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/ARCN/*
- *Beyond Naturalness* by David N. Cole and Laurie Yung, entire book, but with a focus on pp. 31-33. This section is available for preview on Google Books. *http://books.google.com/books?id=gfErgkCy0HkC&printsec=frontcover&cd=1&source=gbs_ViewAPI#v=onepage&q&f=false*
- *Interior Arctic Climate Drivers table* and Regional climate change summaries for ARCN parks online at *http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/ARCN/*



Corporations that derived value from scenarios

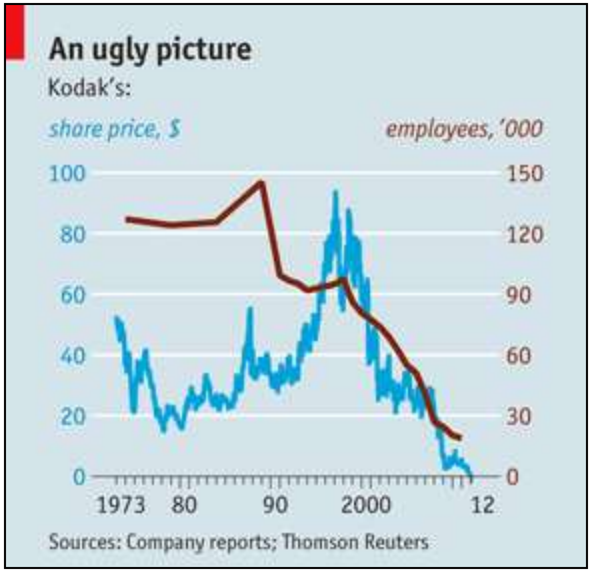
- **Shell:** pioneered the commercial use of scenarios; prepared for and navigated the oil crises of the 1970s, and the opening of the Russian market in the 1990s
- **Morgan Stanley Japan:** identified looming problems in Asian financial markets in the late 1990s. Held back on retail investments, and engaged fully with governments and regulators.
- **UPS:** in the late 1990s, used scenarios to identify and explore the powerful forces of globalization and consumer power. As a result, made significant investments (like Mail Boxes Etc) that enabled them to directly reach the end consumer.
- **Microsoft:** Amidst great uncertainty, Microsoft used scenarios (including early indicators) to provide signals as to which platforms/technologies/channels would prevail.

One corporation that… didn't

Eastman Kodak

- Failure to diversify adequately
- Did not correctly read emerging markets
- Acted slowly, waiting for "perfect" products
- Complacency

http://www.economist.com/node/21542796



Climate Change in Alaska: the bottom line

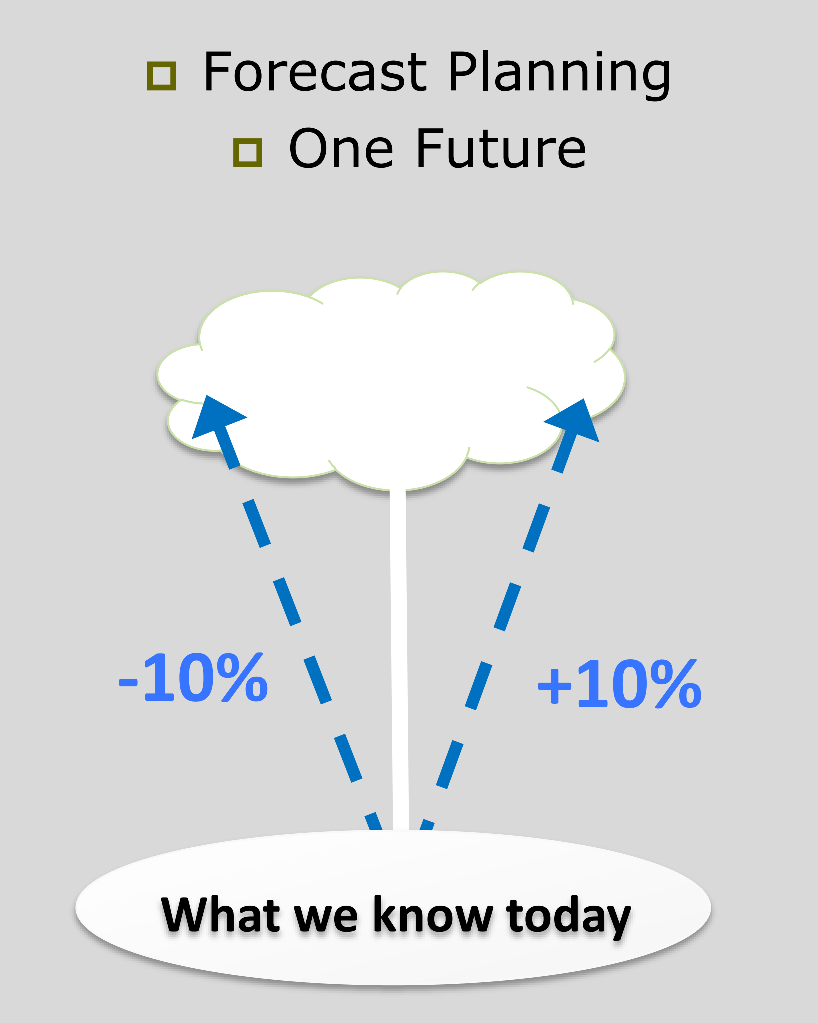
alaskarenewableenergy.org

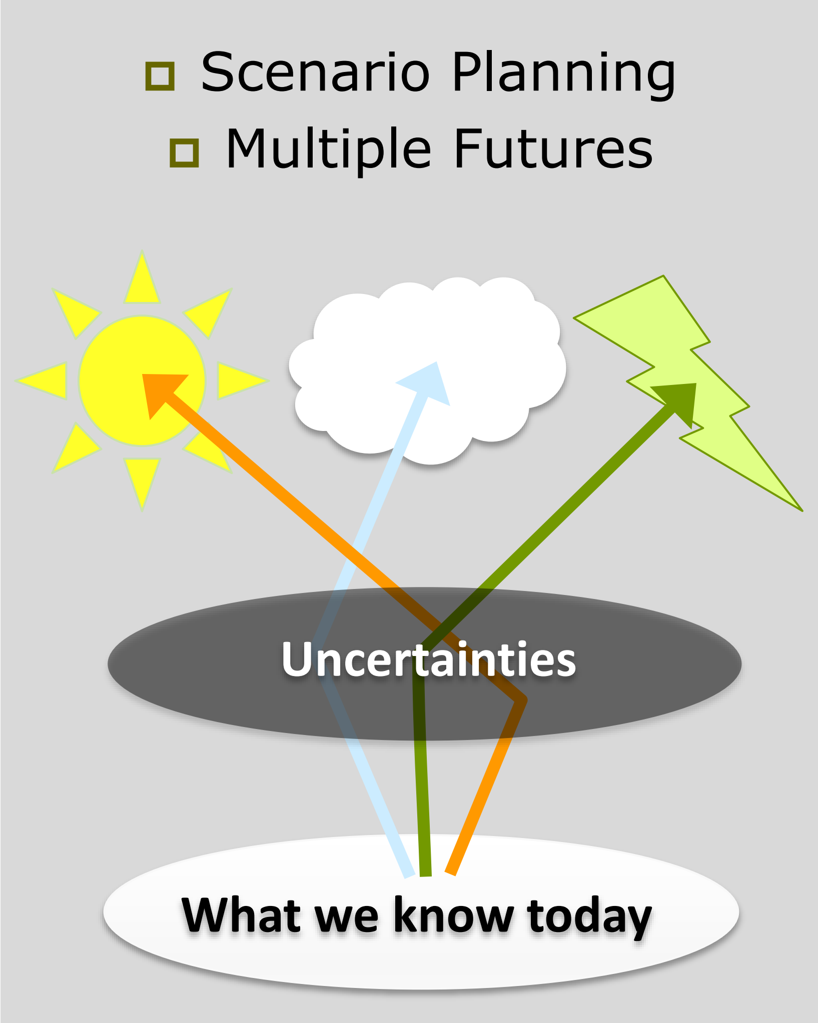
www.nenananewslink.com

- Change is happening, and will continue for decades regardless of mitigation efforts.
- Key tipping points may be crossed, e.g fire, permafrost, sea ice, biome shift, glacial loss.
- High uncertainty results in divergent possible futures for many important variables.

Scenario Planning vs. Forecasting

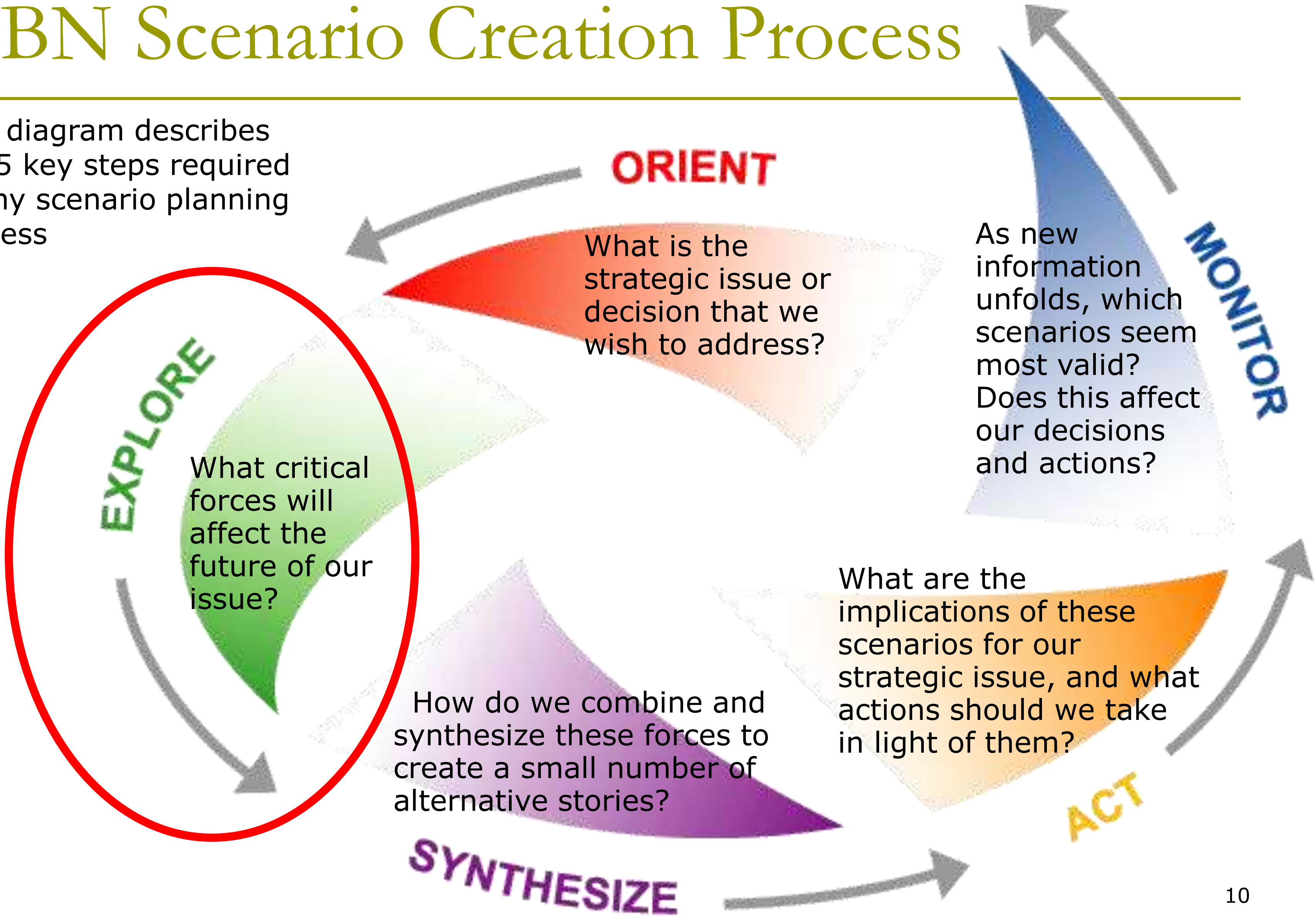
- *Scenarios overcome the tendency to predict, allowing us to see multiple possibilities for the future*





Explaining Scenarios: A Basic GBN Scenario Creation Process

This diagram describes the 5 key steps required in any scenario planning process



Step one: Orient

What is the strategic issue or decision that we wish to address?

How can NPS managers best preserve (*protect?*) the natural and cultural resources and values within their jurisdiction in the face of climate change?

Gates of the Arctic National Park
photo credits: Tom Moran, Jay Cable, Amy Marsh

To answer this challenge, we need to explore a broader question:

How will climate change effects impact the landscapes within which management units are placed over the next 50 to 100 years?

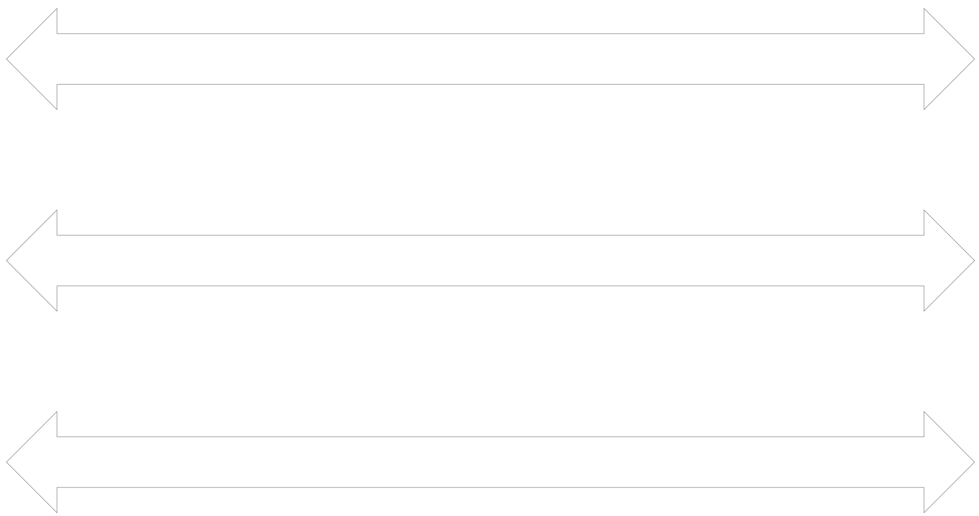
Step Two: Explore

What **critical forces** will affect the future of our issue?

CRITICAL UNCERTAINTIES

BIOREGION: ______________

Over the next 50 – 100 years, what will happen to . . . ?



Critical forces generally have unusually **high impact** and unusually **high uncertainty**

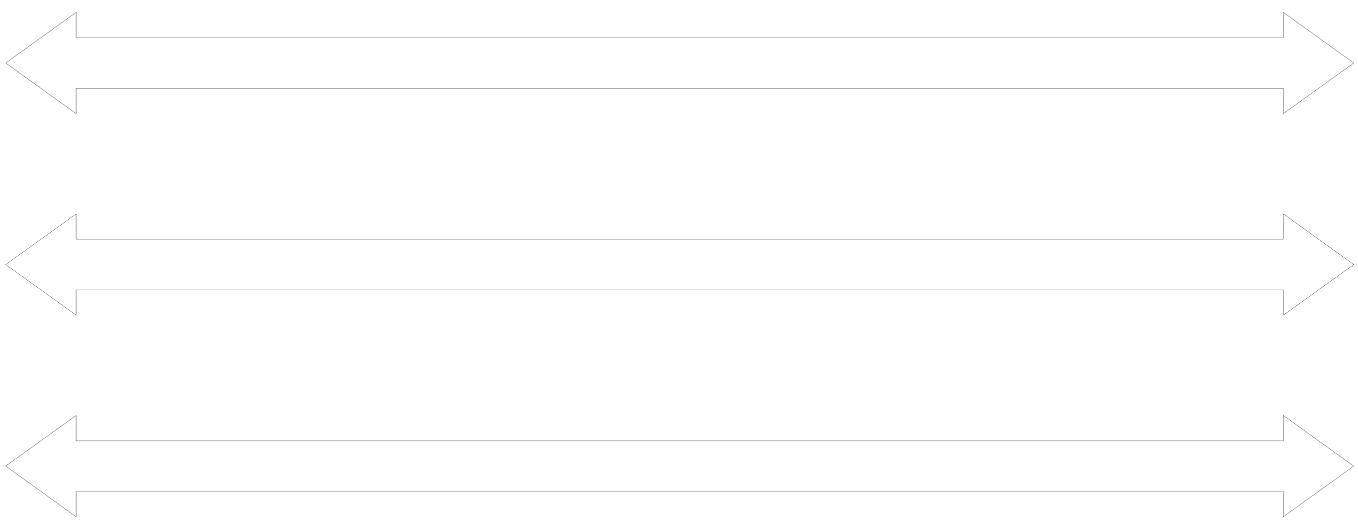
Selecting Drivers

What **critical forces** will affect the future of our issue?

CRITICAL UNCERTAINTIES

BIOREGION: ______________

Over the next 50 – 100 years, what will happen to . . . ?



Selecting Drivers – Key points

- Drivers are the **critical forces** in our scenarios planning process.
- Critical forces generally have unusually **high impact** and unusually **high uncertainty**
- We are aiming to create scenarios that are:
  - **Challenging**
  - **Divergent**
  - **Plausible**
  - **Relevant**

CLIMATE SCENARIOS

BIOREGION: ______________

Pick drivers with a wide range of possible outcomes

Choose drivers that impact several sectors, e.g tourism, subsistence, and wildlife, not just one

Select drivers with a high enough likelihood to be convincing to stakeholders

Select drivers with effects in most of the parks in the network

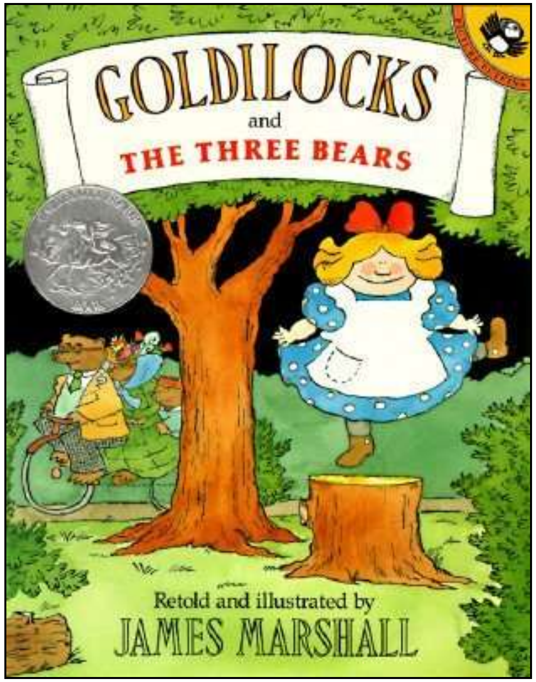
Avoid pairs of drivers that are too similar – think of the effects of crossing them with one another

Choose drivers that lead to the effects that are most critical

Keep in mind….

We will be synthesizing our results to create a small number of alternative stories

- Sixteen (or more) choices available (4x4)
- Need to select only 3-4 to turn into narratives and planning tools
- Focus on scenarios that are:
  - Challenging
  - Divergent
  - Relevant
  - Plausible
- Create a narrative (story) about each scenario



Climatic drivers of Alaskan change

Earth/sun orbital variations (10,000+ yrs)

Greenhouse gas, aerosol forcing (10s-100 yrs)

Internal variability (1-10s yrs)
(e.g., Pacific Decadal Oscillation, Arctic Oscillation)

Internal feedbacks (land surface, sea ice,…)

Climate Change Scenario Drivers

TEMPERATURE AND LINKED VARIABLES:

thaw, freeze, season length, extreme days, permafrost, ice, freshwater temperature, fire

PRECIPITATION AND LINKED VARIABLES:

rain, snow, water availability, storms and flooding, humidity

PACIFIC DECADAL OSCILLATION (PDO):

definition, effects, and predictability

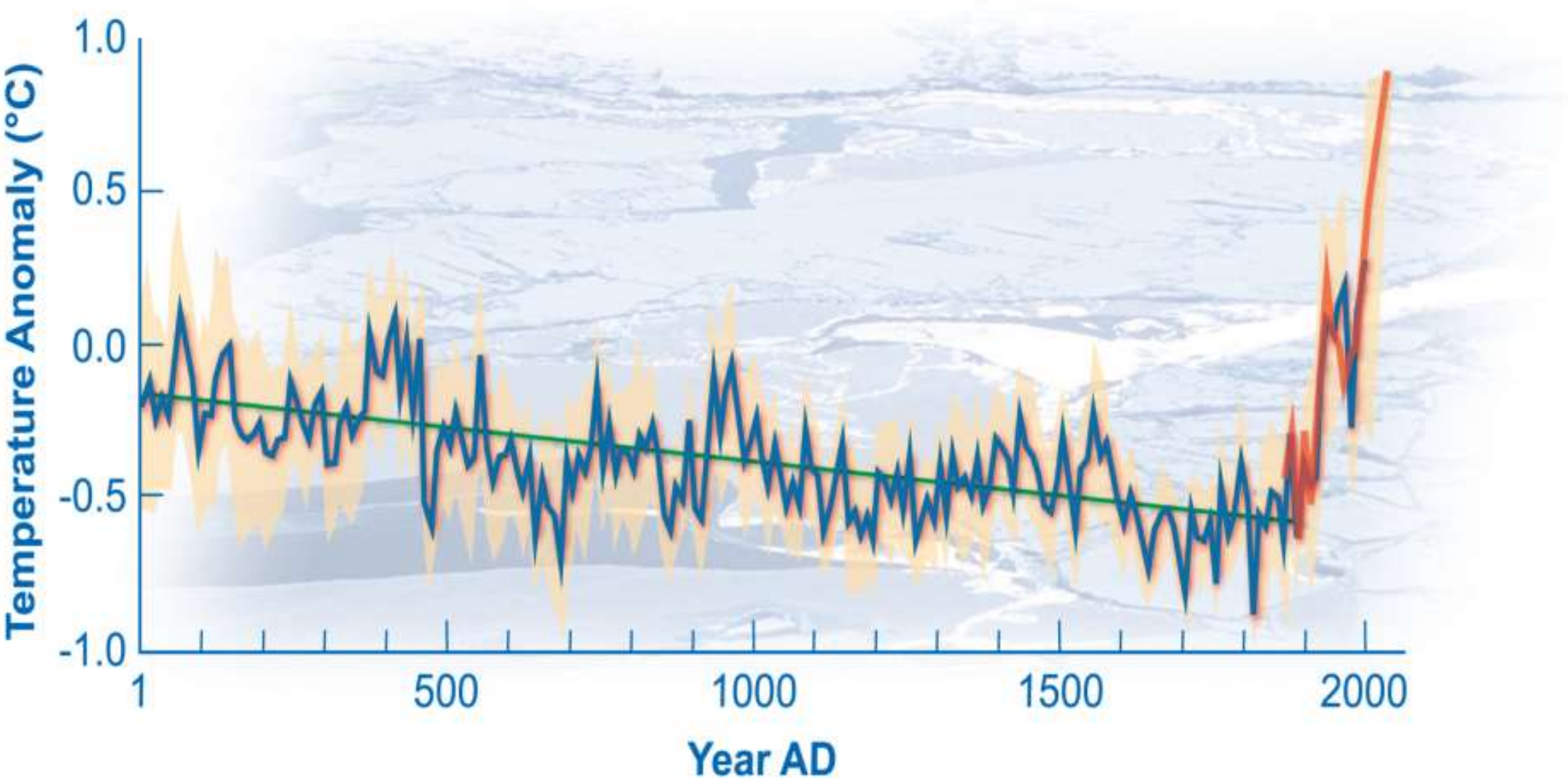
SEA LEVEL:

erosion also linked to sea ice and storms

OCEAN ACIDIFICATION

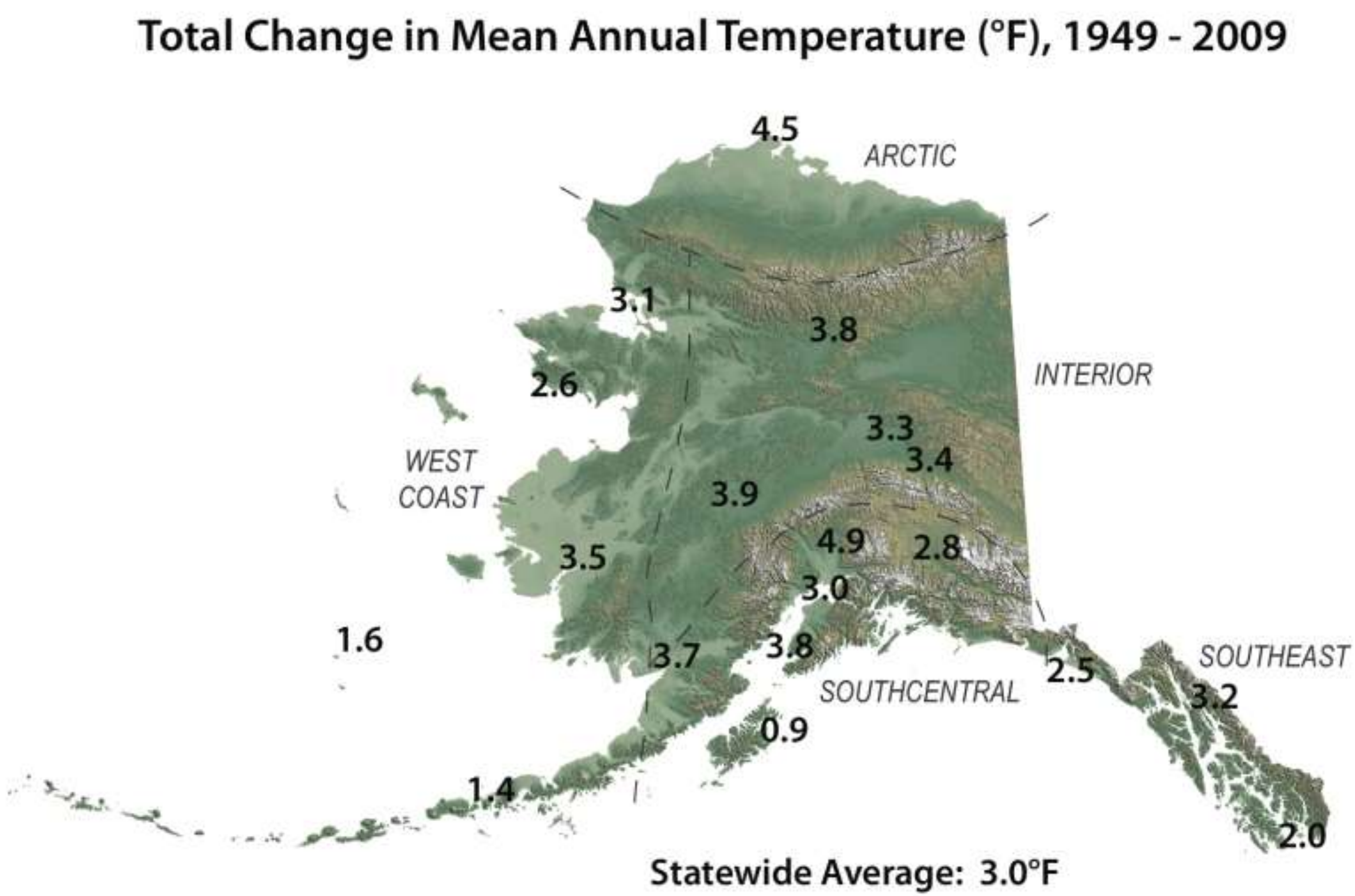
Reconstruction of summer Arctic temperatures

[Kaufman et al., 2009, Science]



The attribution issue: Temperature change in Alaska, 1949-2009

[from Alaska Climate Research Center]



Temperature changes (°F) in Alaska: 1949-2009

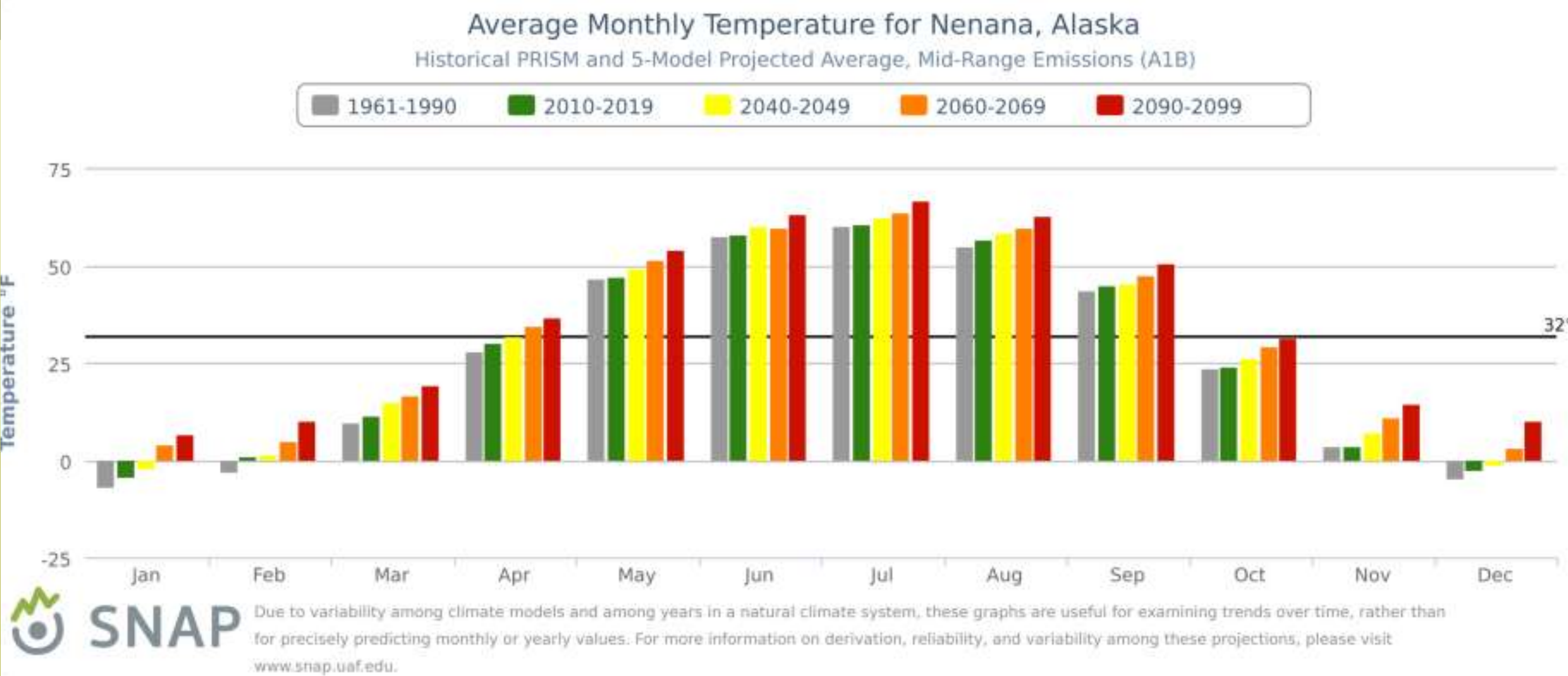
Total Change in Mean Seasonal and Annual Temperature (°F), 1949 - 2009

Region	Location	Winter	Spring	Summer	Autumn	Annual
Arctic	Barrow	6.7	4.5	3.0	3.7	4.5
Interior	Bettles	8.1	4.3	1.8	1.1	3.8
	Big Delta	8.9	3.4	1.2	0.0	3.4
	Fairbanks	7.4	3.6	2.3	-0.2	3.3
	McGrath	7.4	4.6	2.7	0.8	3.9
West Coast	Kotzebue	6.3	1.8	2.6	1.4	3.1
	Nome	4.2	3.3	2.5	0.4	2.6
	Bethel	6.6	4.8	2.3	0.0	3.5
	King Salmon	7.9	4.5	1.7	0.6	3.7
	Cold Bay	1.5	1.6	1.7	0.8	1.4
	St Paul	0.8	2.1	2.6	1.1	1.6
Southcentral	Anchorage	5.8	3.3	1.6	1.5	3.0
	Talkeetna	8.4	5.2	3.1	2.4	4.9
	Gulkana	7.7	2.4	1.0	0.1	2.8
	Homer	5.9	3.8	3.3	1.8	3.8
	Kodiak	0.7	2.1	1.2	-0.4	0.9
Southeast	Yakutat	4.6	2.8	1.8	0.4	2.5
	Juneau	6.2	2.9	2.2	1.4	3.2
	Annette	3.4	2.3	1.8	0.3	2.0
	Average	5.7	3.3	2.1	0.9	3.0

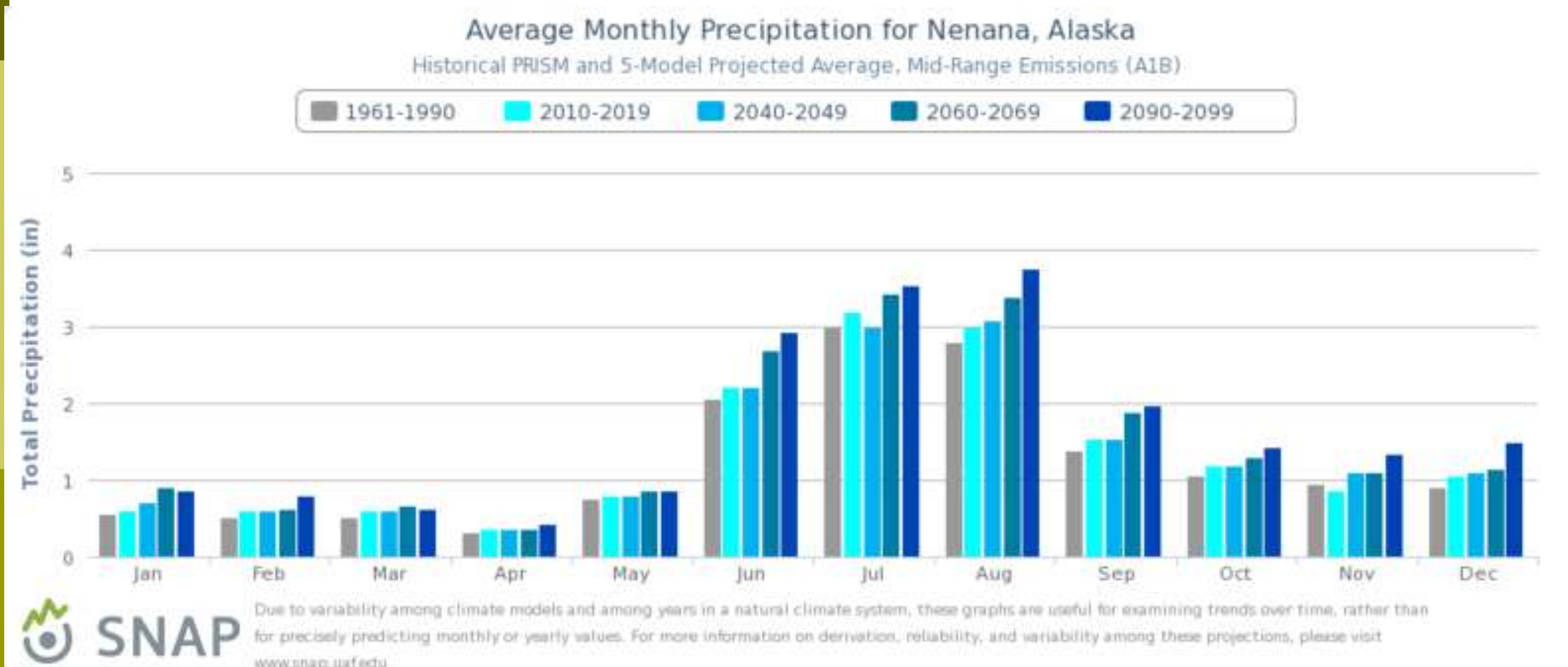
Alaska Climate Research Center

Geophysical Institute, University of Alaska Fairbanks

Monthly temperature projections for Nenana A1B (mid-range) scenario)



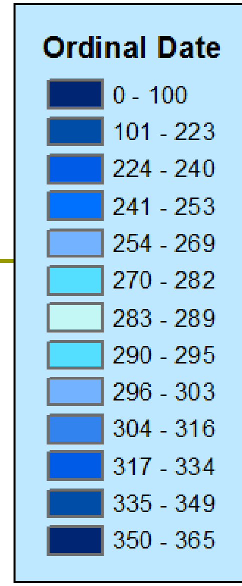
Projected monthly precipitation for Nenana

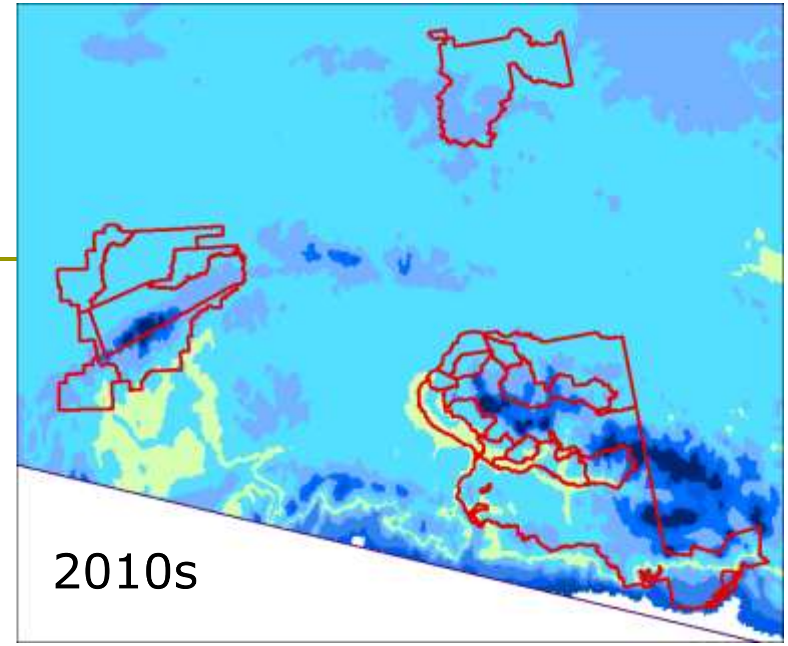


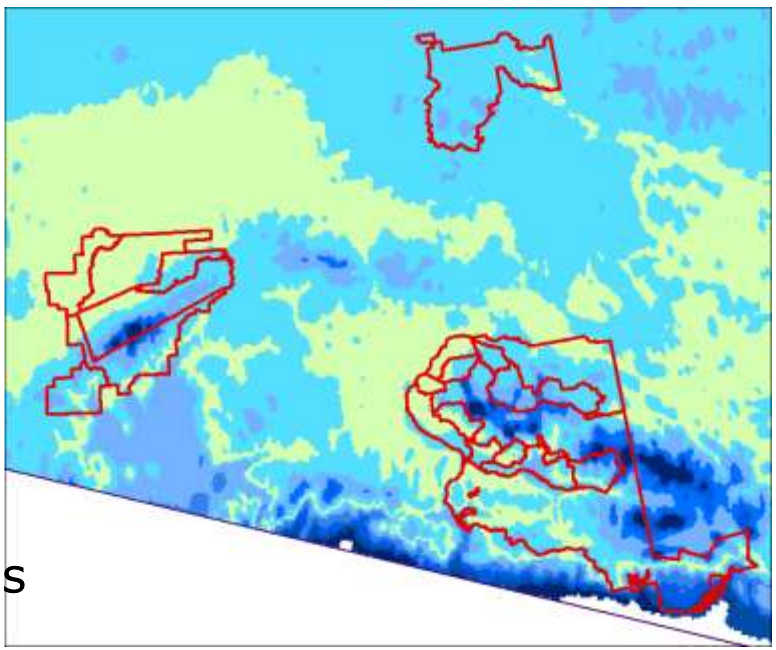
Central Alaska Date of Freeze Projections

5-model average
A1B scenario

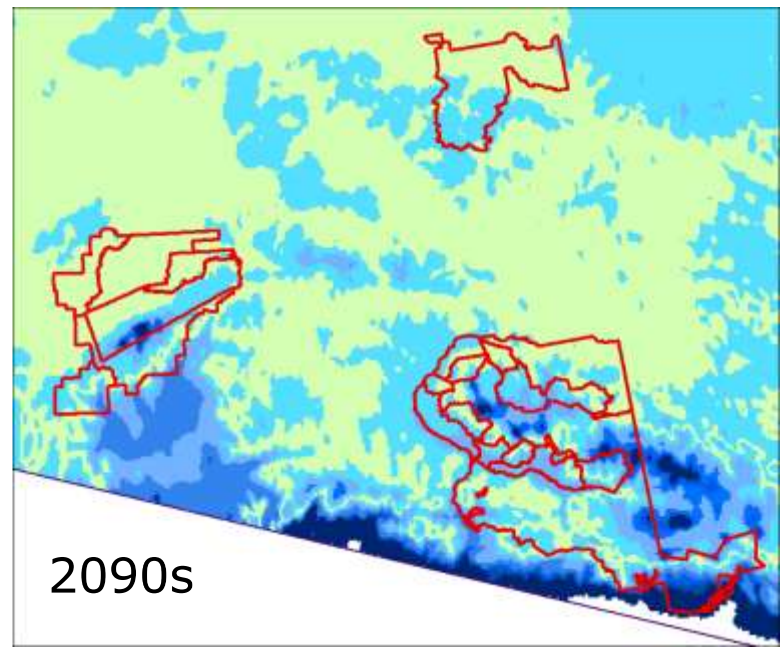
SNAP







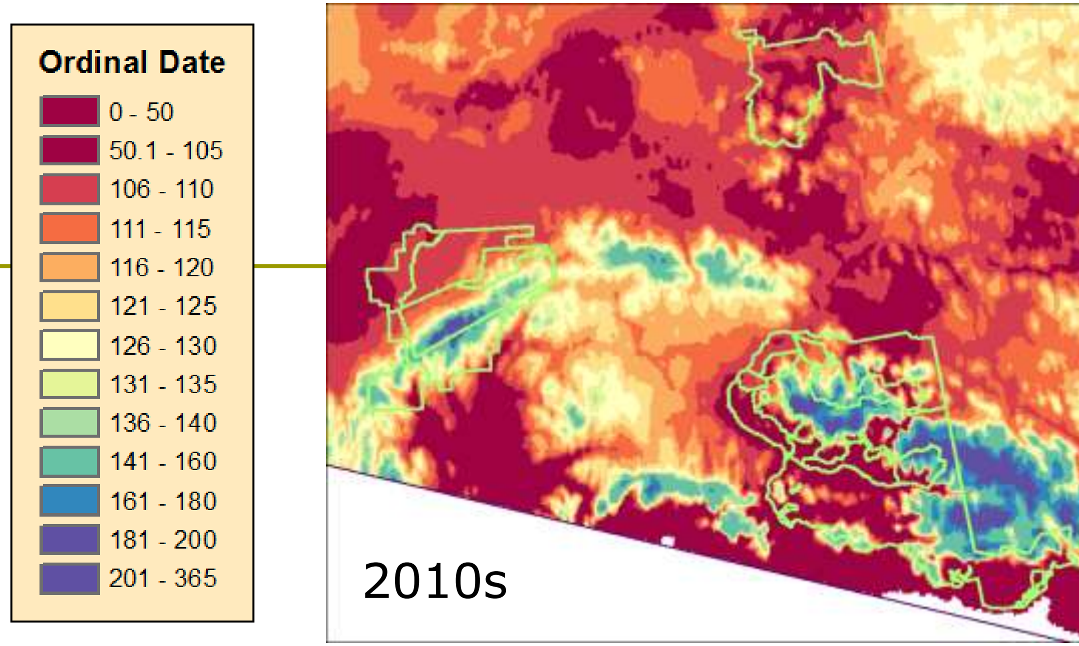
2050s

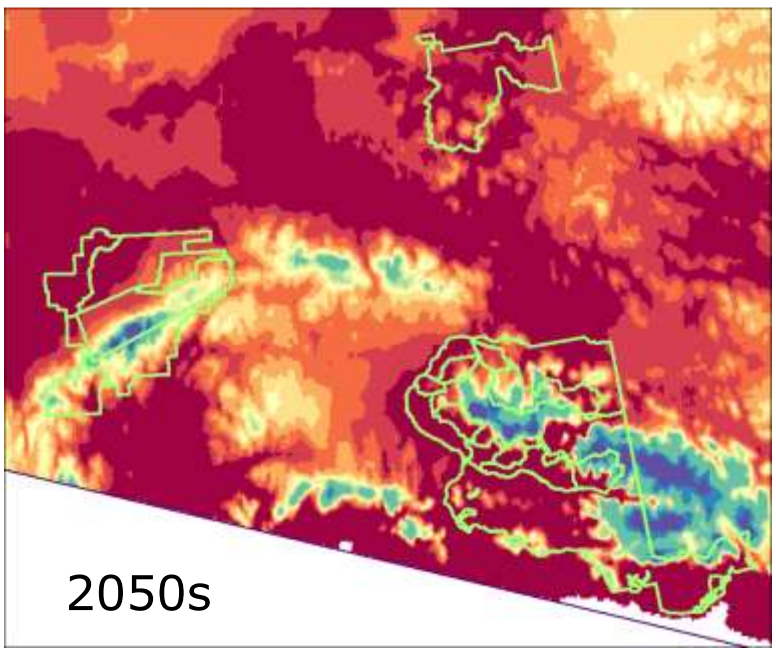


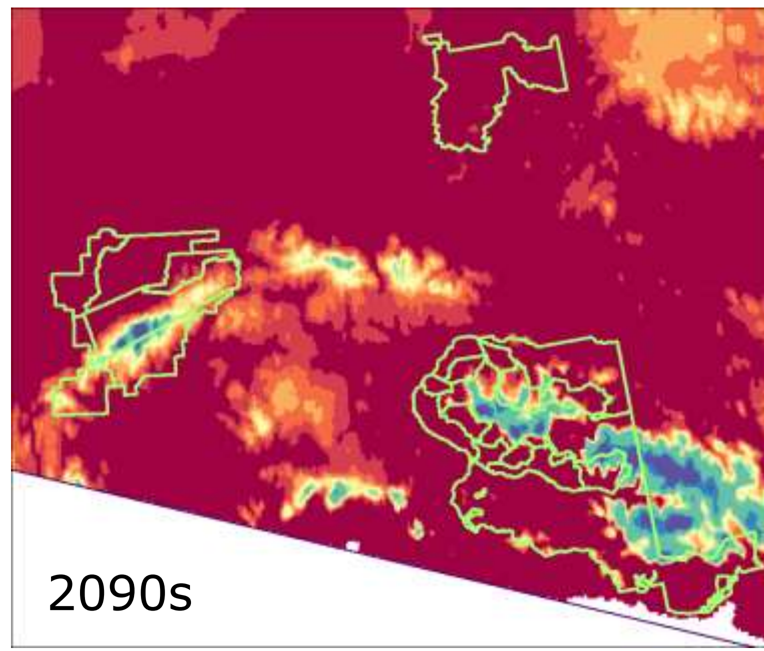
Central Alaska Date of Thaw Projections

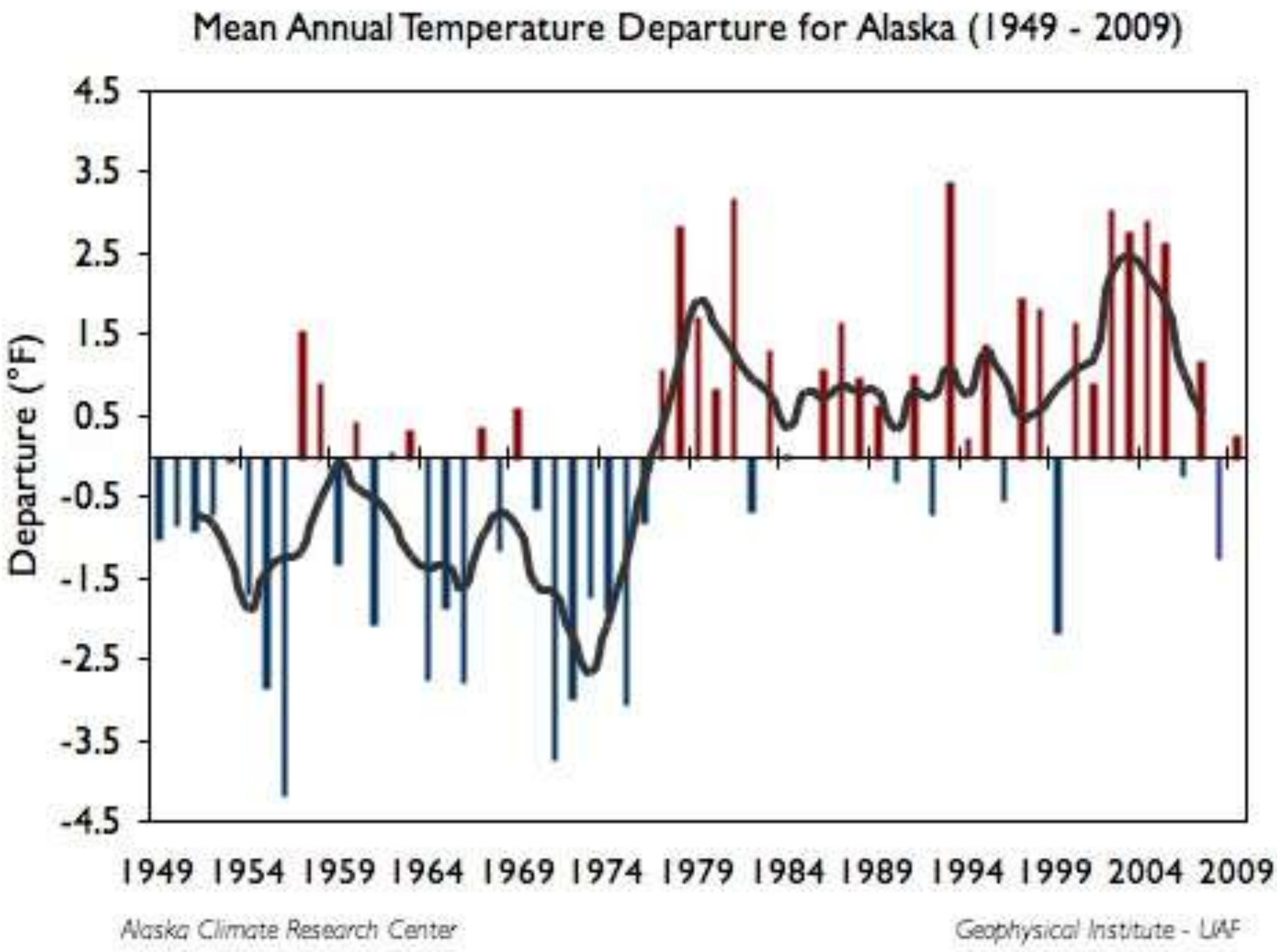
5-model average
A1B scenario

SNAP

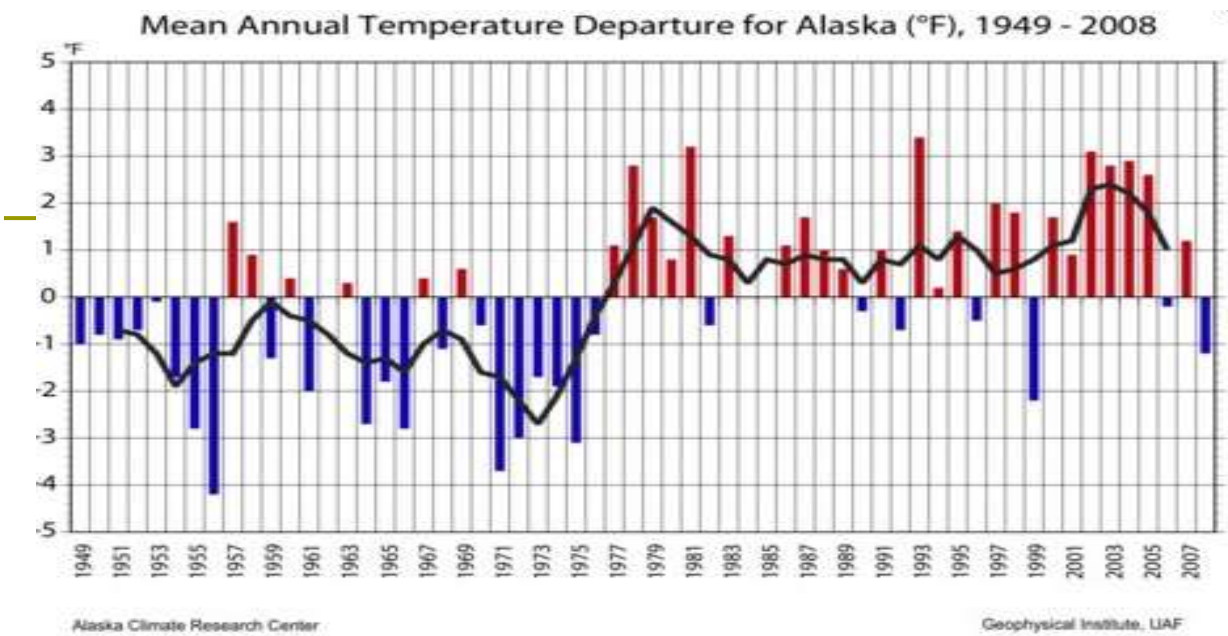




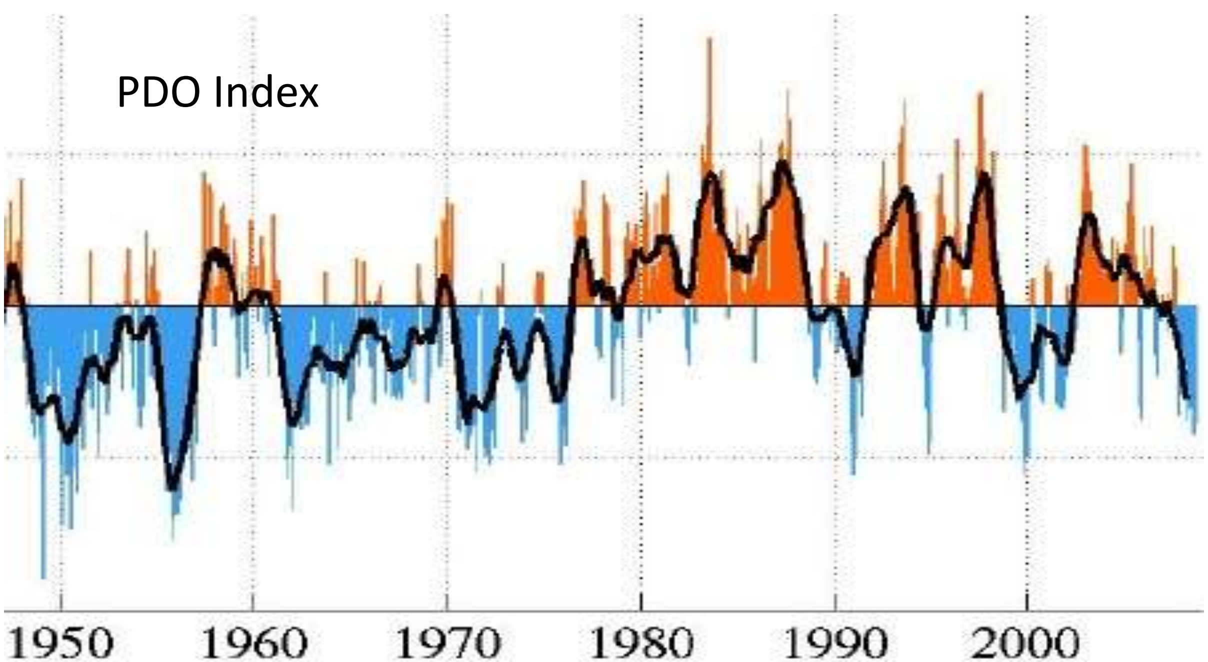




(from Alaska Climate Research Center)



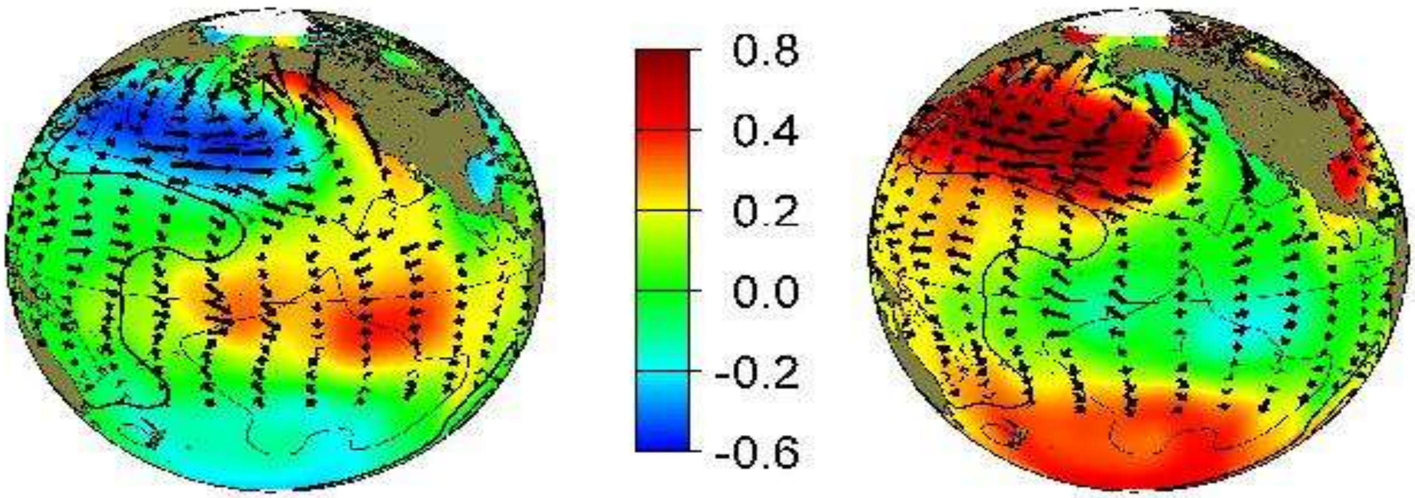
Alaska annual temperature anomalies

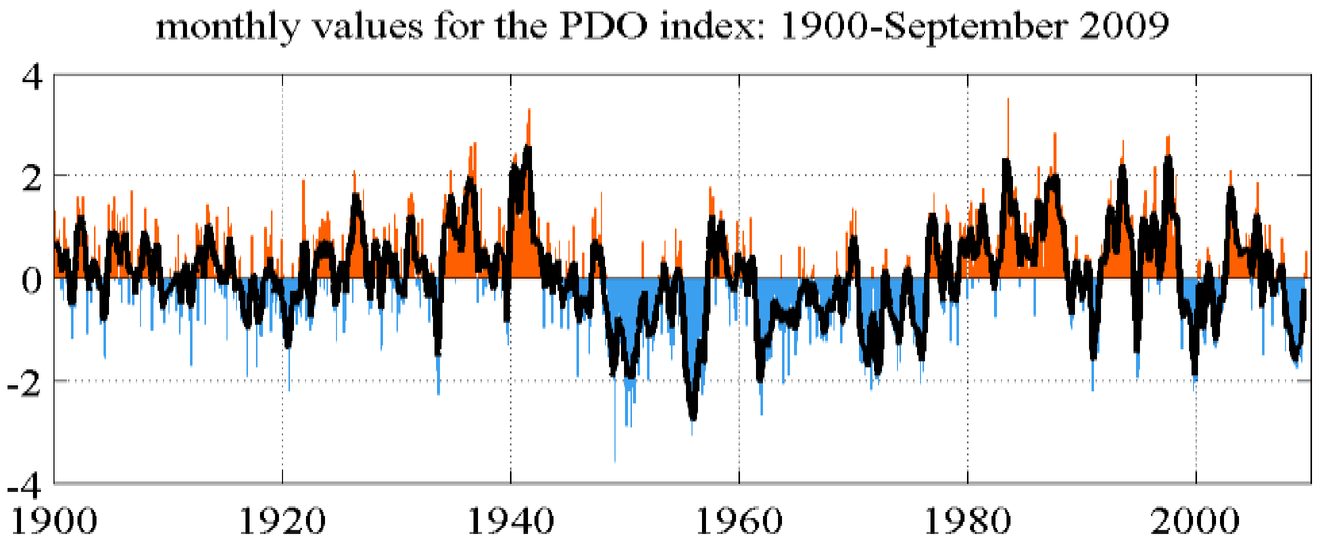


Pacific Decadal Oscillation Index

The Pacific Decadal Oscillation
[from JISAO, Univ. Of Washington]

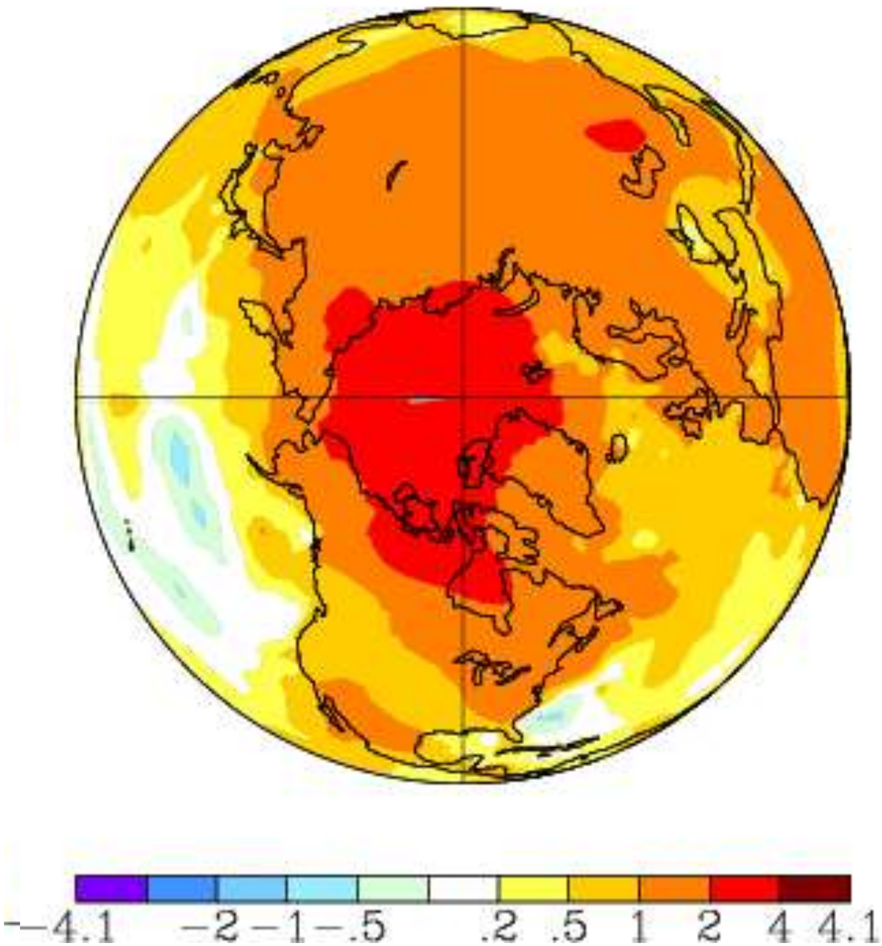
Alaska warm phase   Alaska cold phase



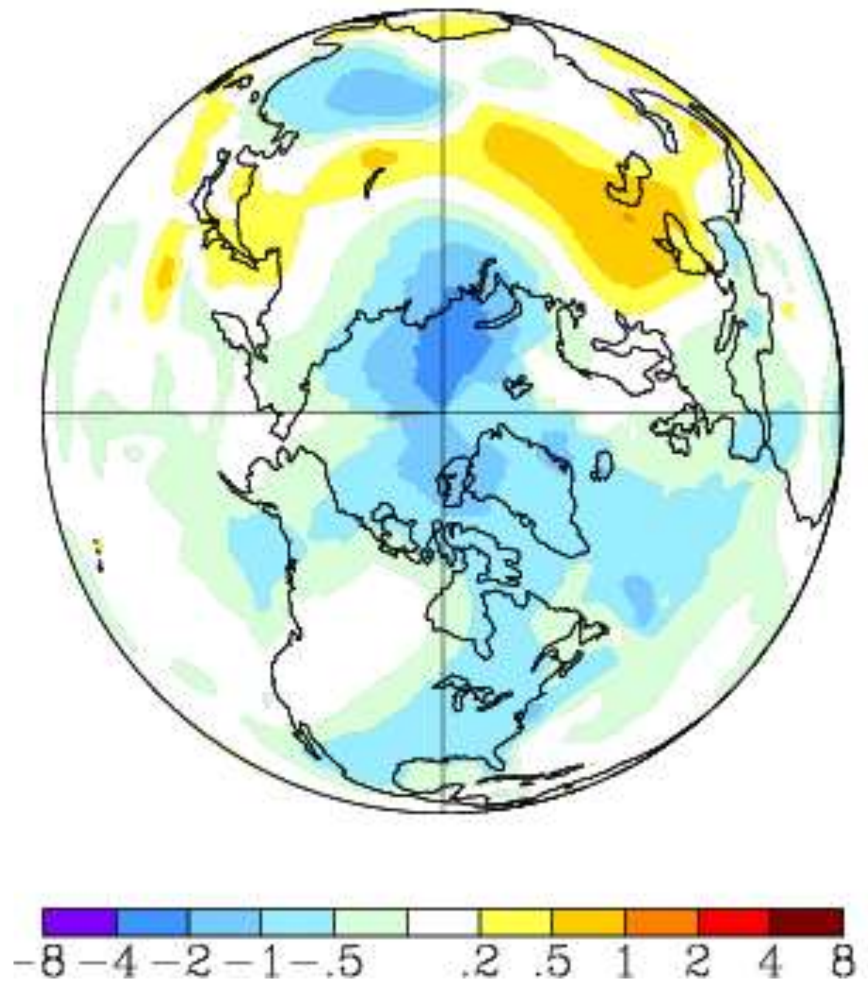


Change in surface air temperature (°C)
[from NASA GISS]

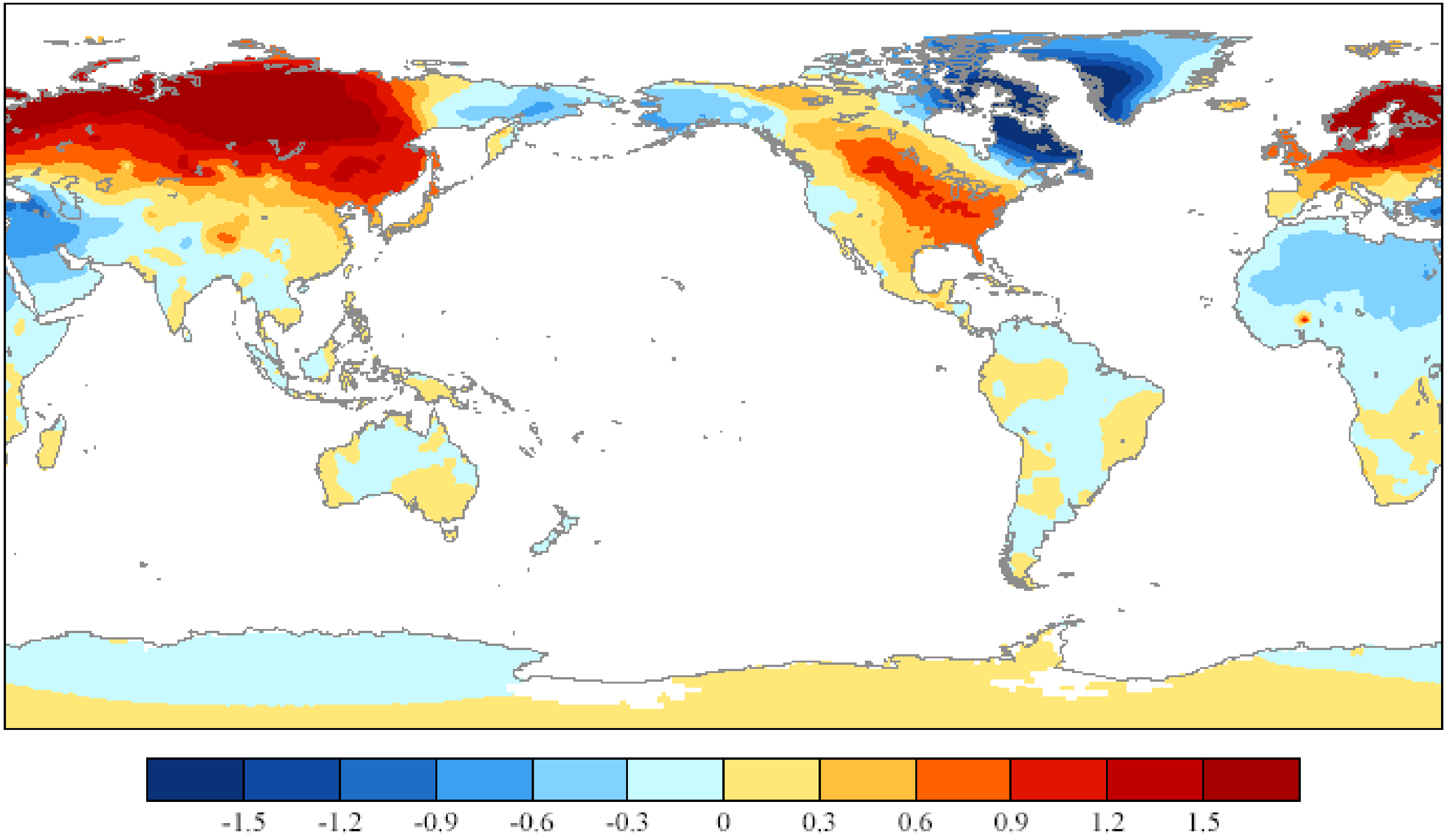
1961-2010



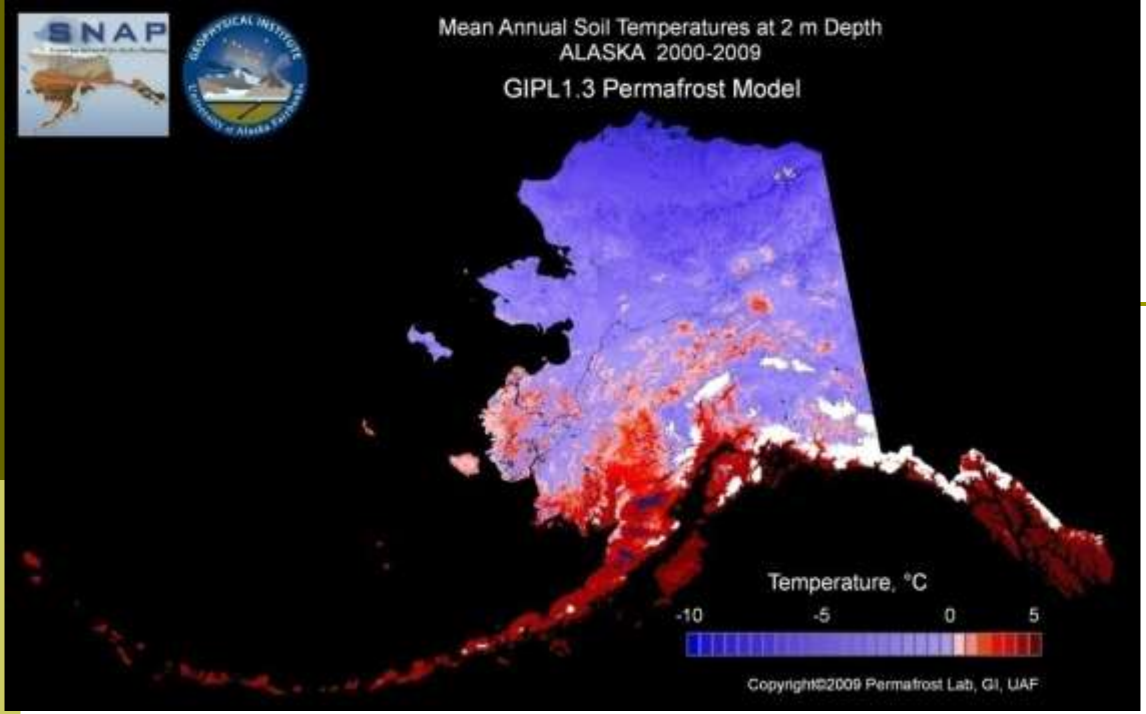
1941-1980



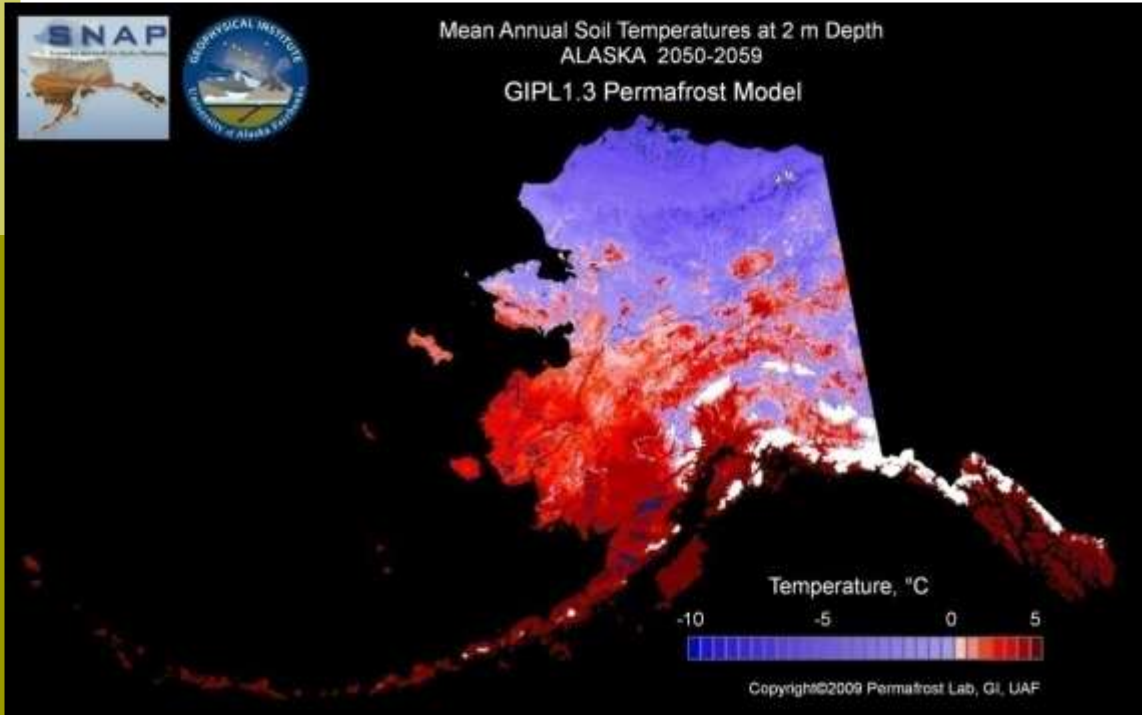
Arctic Oscillation's contribution to recent winter temperature changes (from D. Thompson)



Mean annual soil temp. (2 m depth)

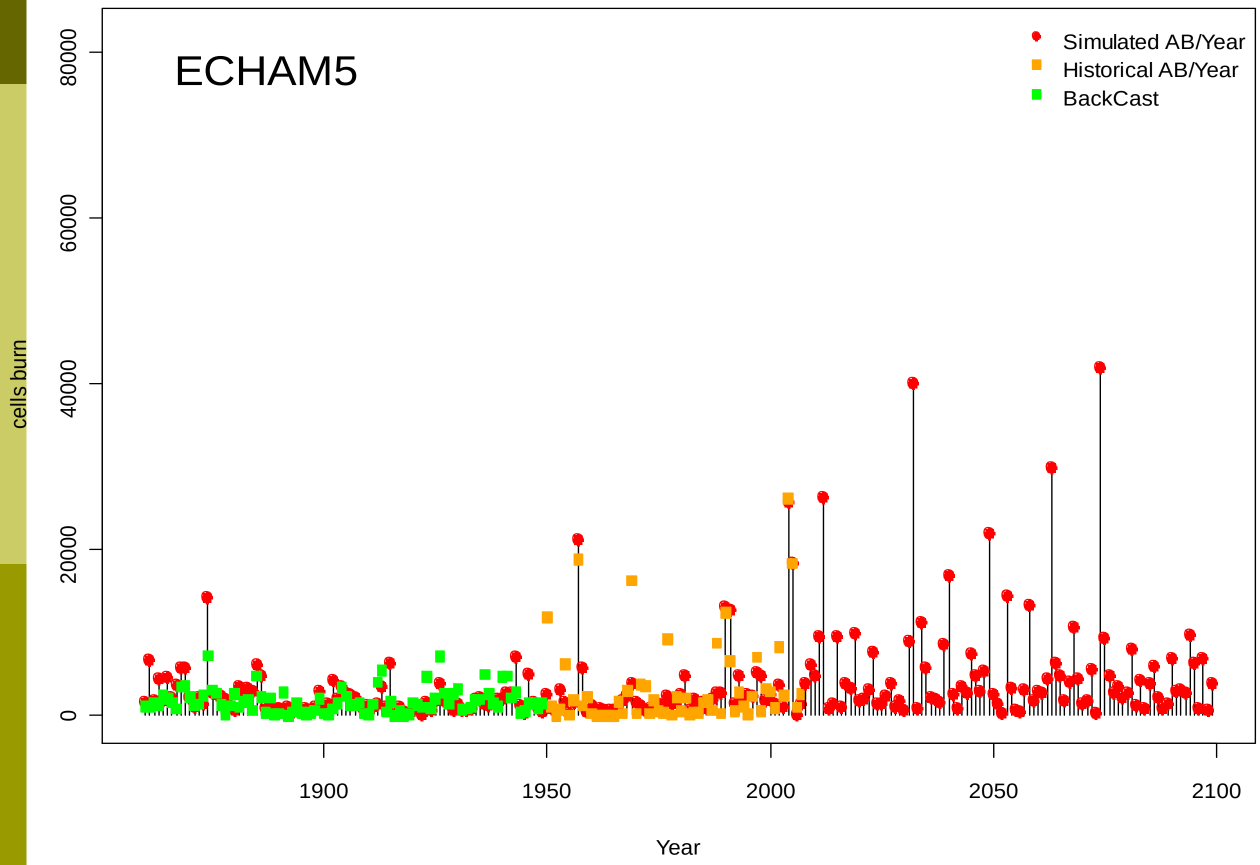


← 2000-2009



← 2050-2059

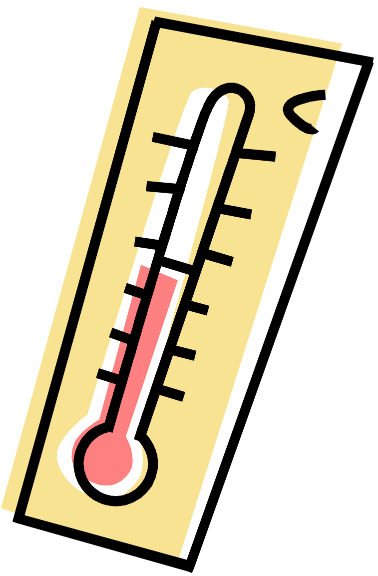
Simulated annual burn area in Alaska (ALFRESCO)



Alaska Division of Forestry
http://forestry.alaska.gov/wildland.htm

Which of the following temperature –related drivers seem most important in your region?

a) growing season length
b) timing of thaw and freeze-up
c) extreme days
d) freshwater temperature
e) glacial melt
f) permafrost thaw



Which of the following precipitation –related drivers seem most important in your region?

a) total annual rain/snow
b) depth of winter snowpack
c) water availability for plants
d) fire
e) other

Which of the following other climate–related drivers seem most important in your region?

a) Pacific Decadal Oscillation (PDO)
b) wind speed
c) storms
d) other

Climate Drivers

- Climate drivers are the **critical forces** in our scenarios planning process.
- Critical forces generally have unusually **high impact** and unusually **high uncertainty**.
- Climate drivers table specific for SE Alaska were compiled by John Walsh and Nancy Fresco of SNAP (see handouts).
- All scenarios are created by examining the intersection of two drivers, creating four sectors.
- **Selection of drivers** is crucial to the planning process.

Critical Uncertainties

Example: Southwest Alaska Network (SWAN) group

Less	Water availability	More
Normal	Stream/lake temps	Warmer
Less	River basin hydrology	More
Measureable	Ocean Acidification	Catastrophic
Historical	Extreme precip/storms	Significant increase
Negative (colder)	PDO	Positive (warmer)

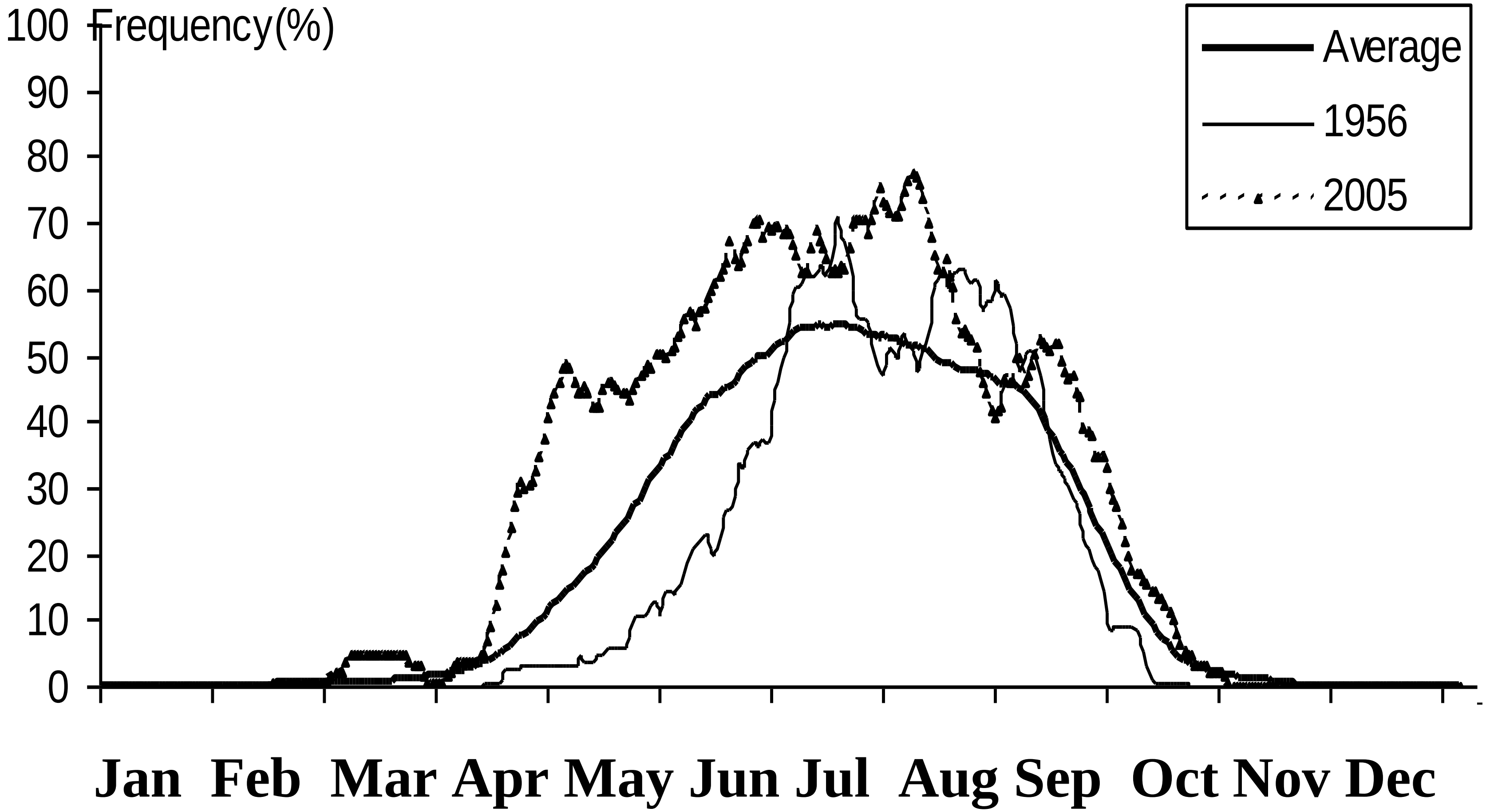
Climate Effects

Climate effects are the outcomes of the critical forces or drivers, as expressed by significant changes in particular parks.

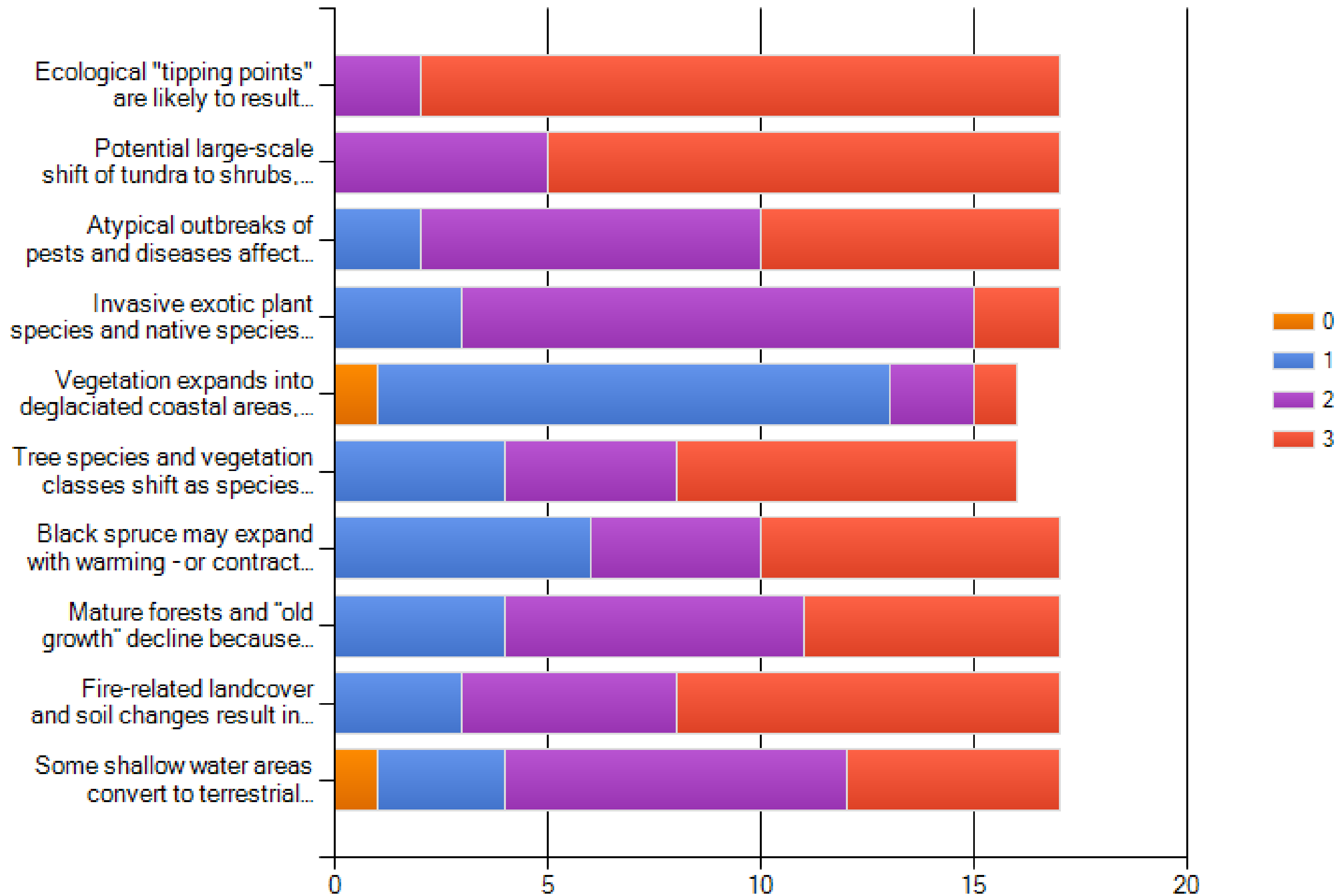
Points to consider include:

- Time frame (20 years? 100 years?)
- Uncertainty (of both driver and effect)
- Severity of effect (and reversibility)
- Scope: what parks, who is impacted?
- Repercussions: what is the story?
- Feedback to policy

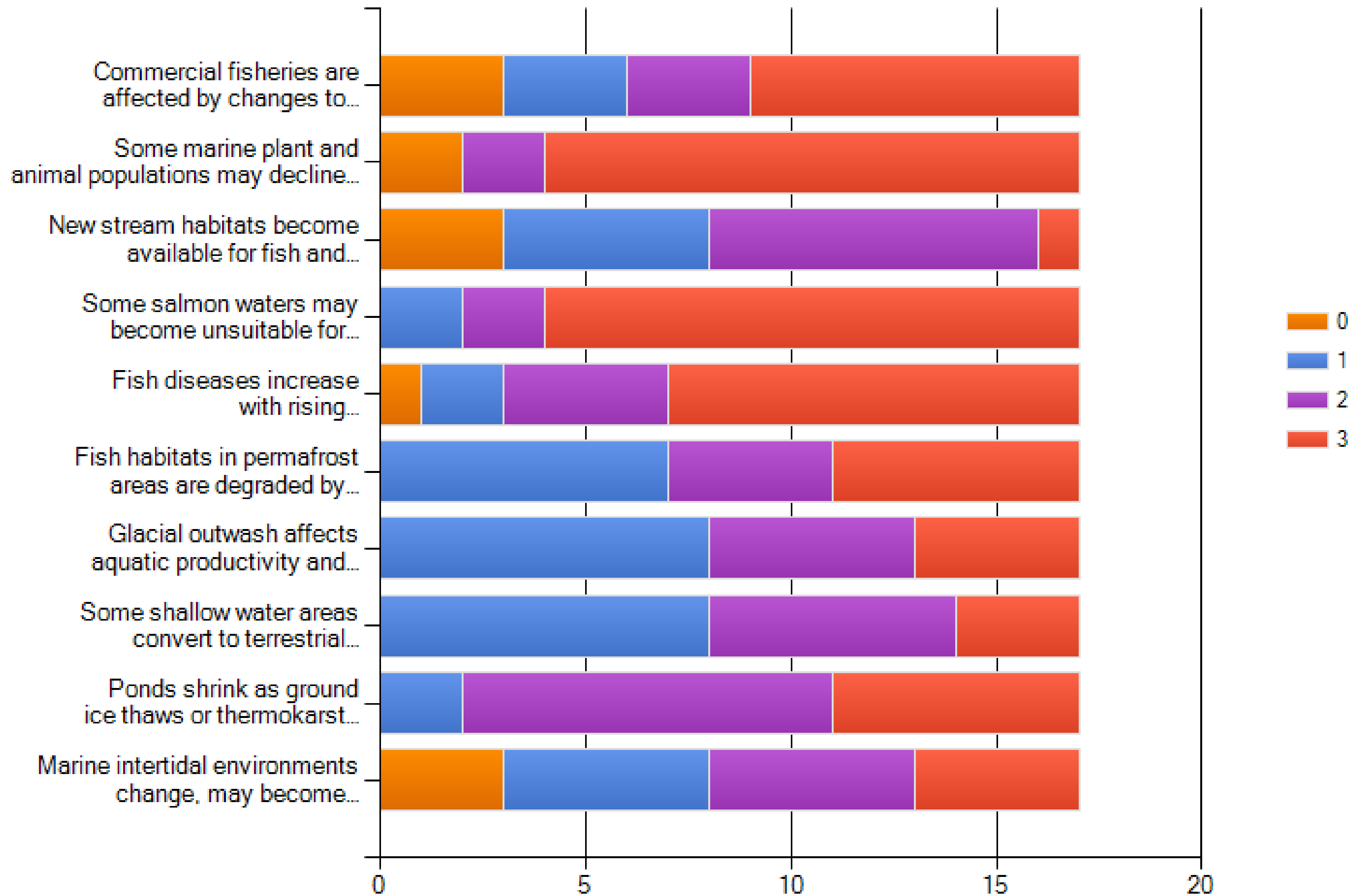
Seasonal frequency of weather conducive to sightseeing (King Salmon, AK)



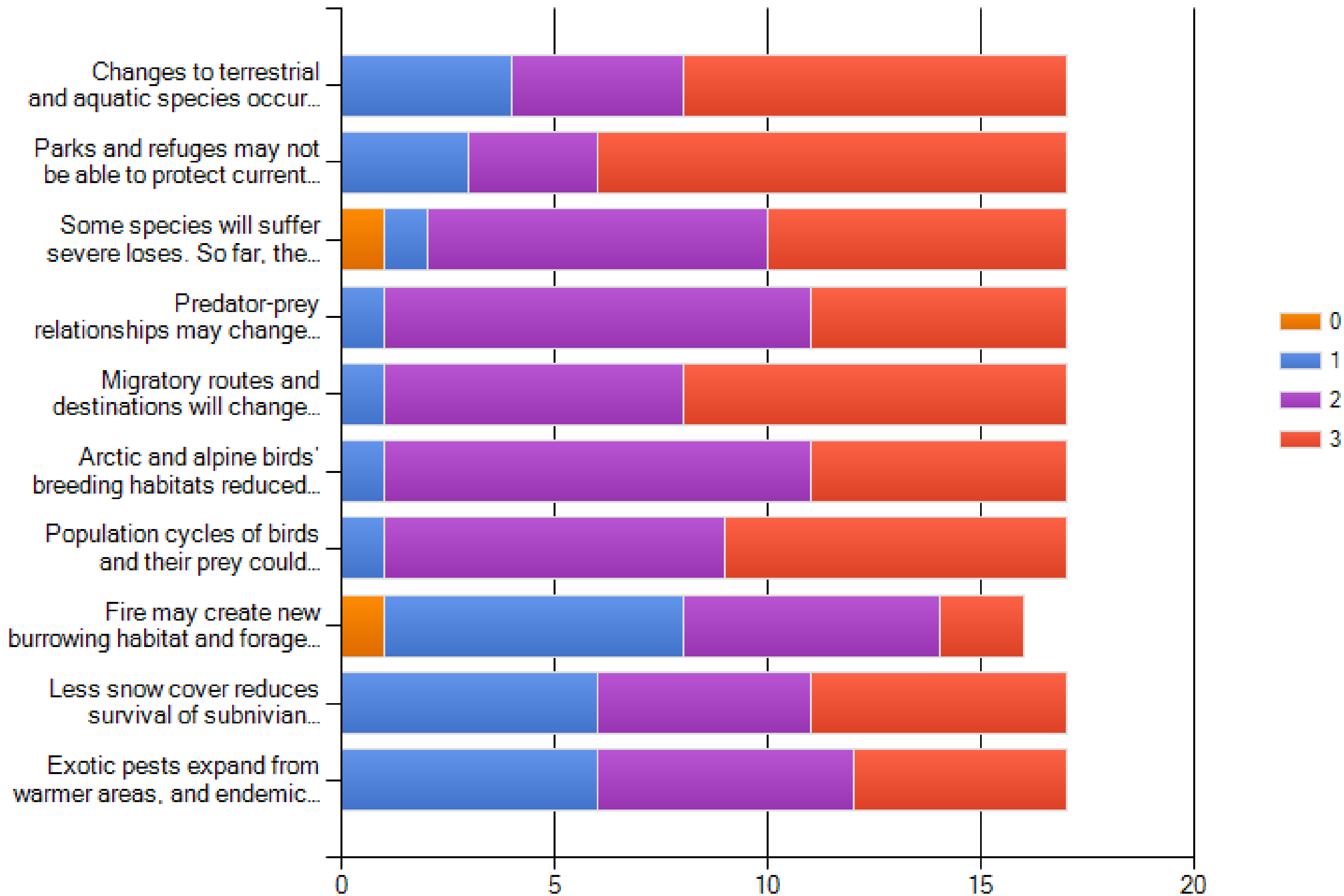
On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on VEGETATION?



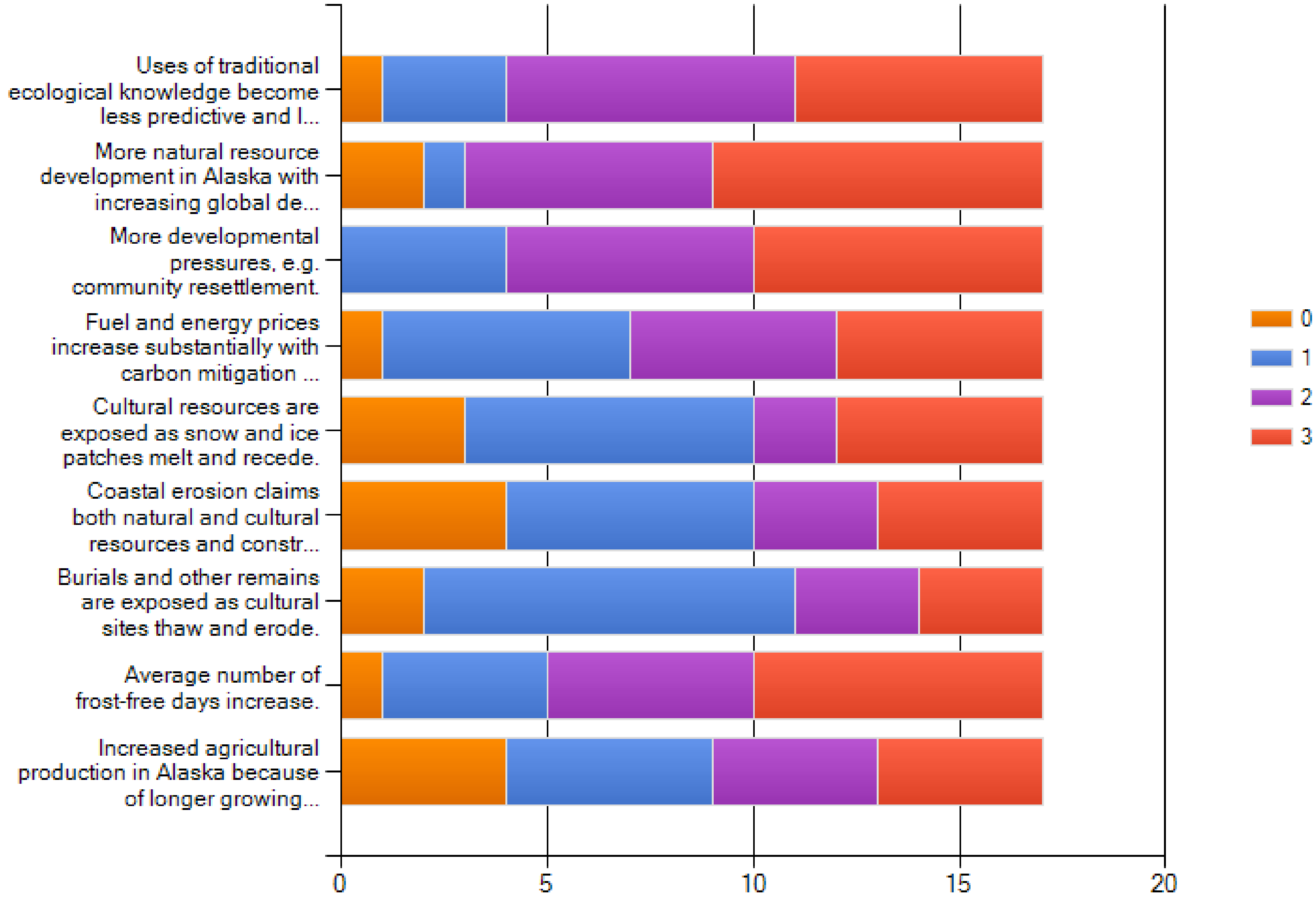
On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on AQUATIC ECOSYSTEMS?



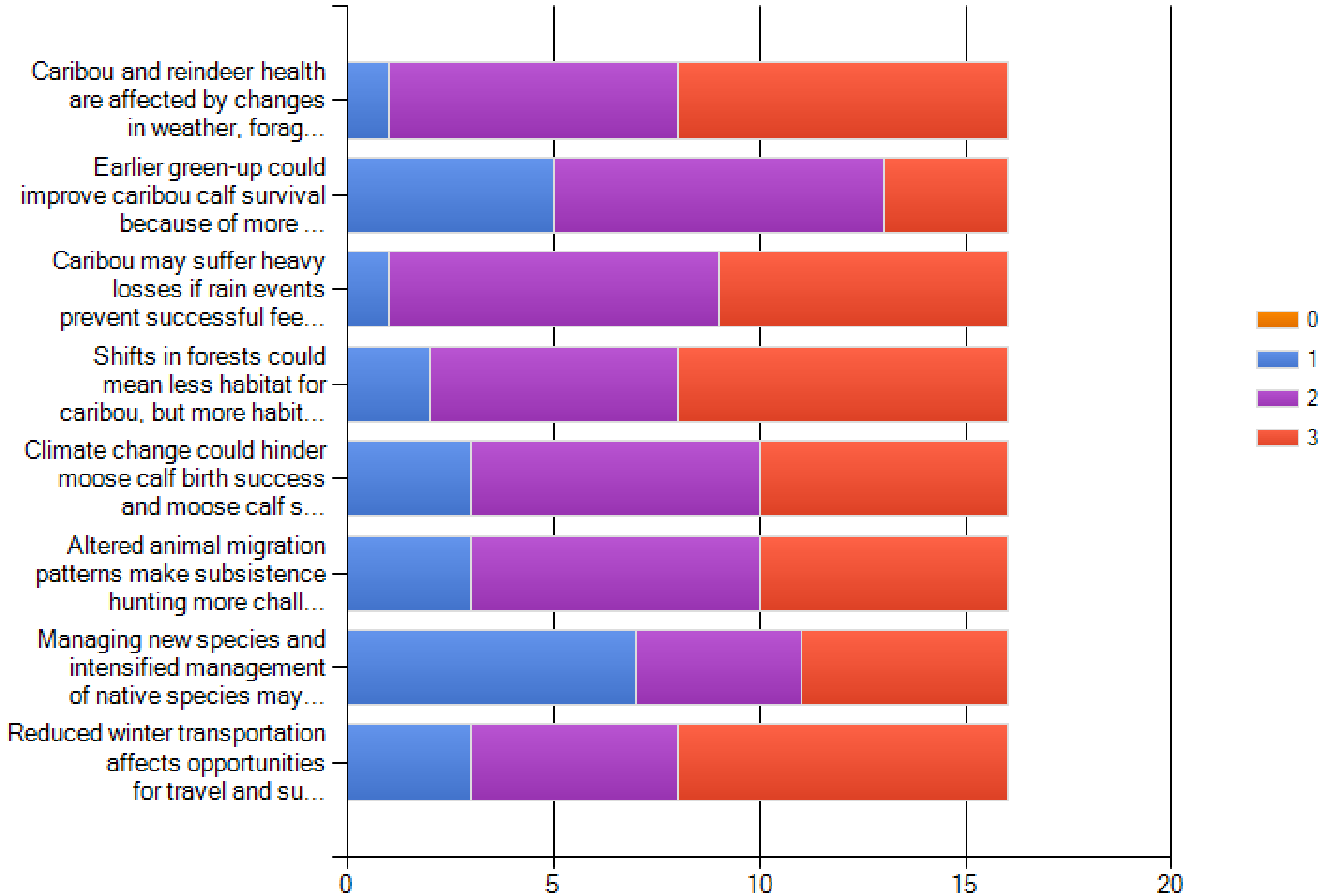
On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on WILDLIFE?



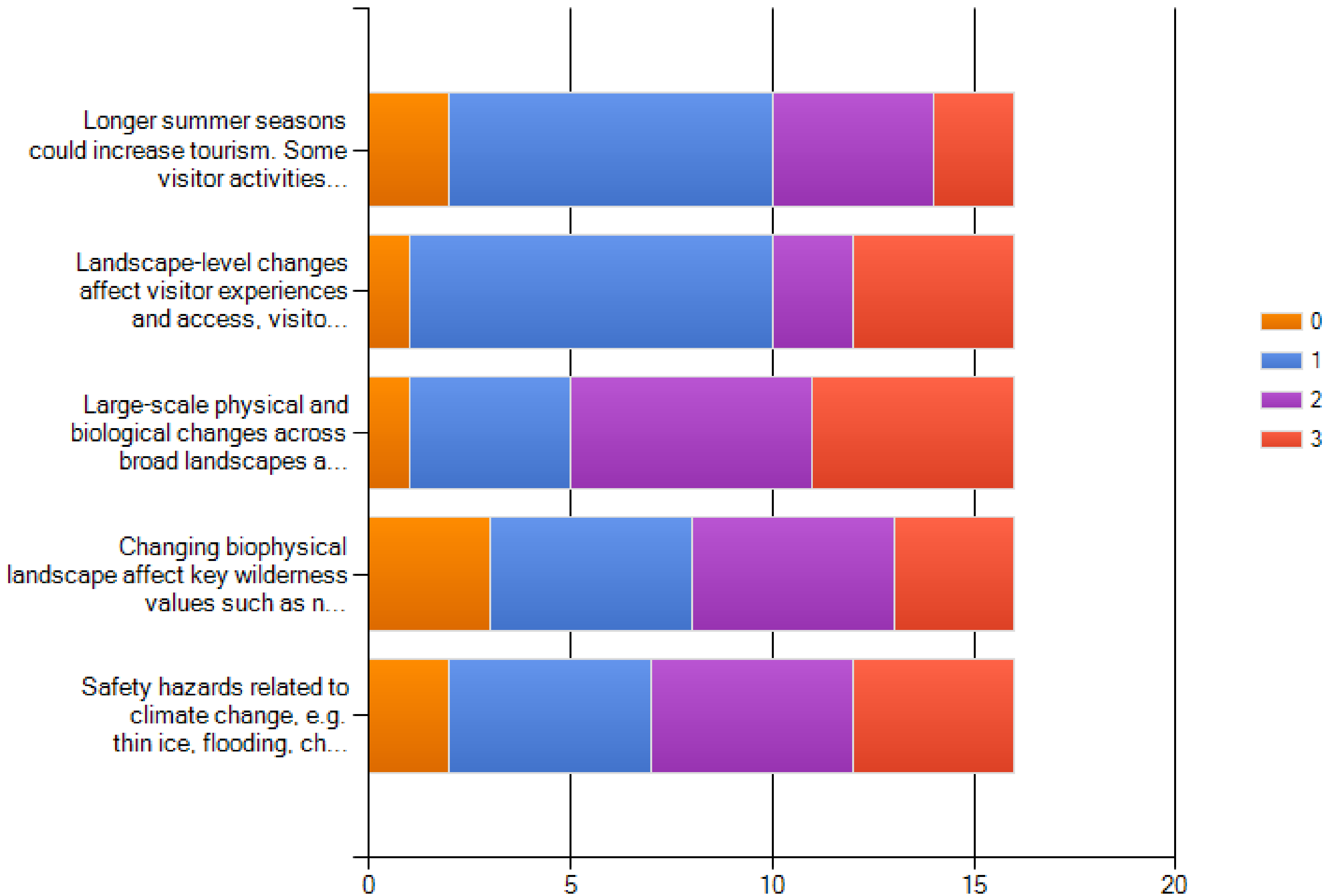
On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects to DEVELOPMENT OPPORTUNITIES AND CULTURAL RESOURCES?



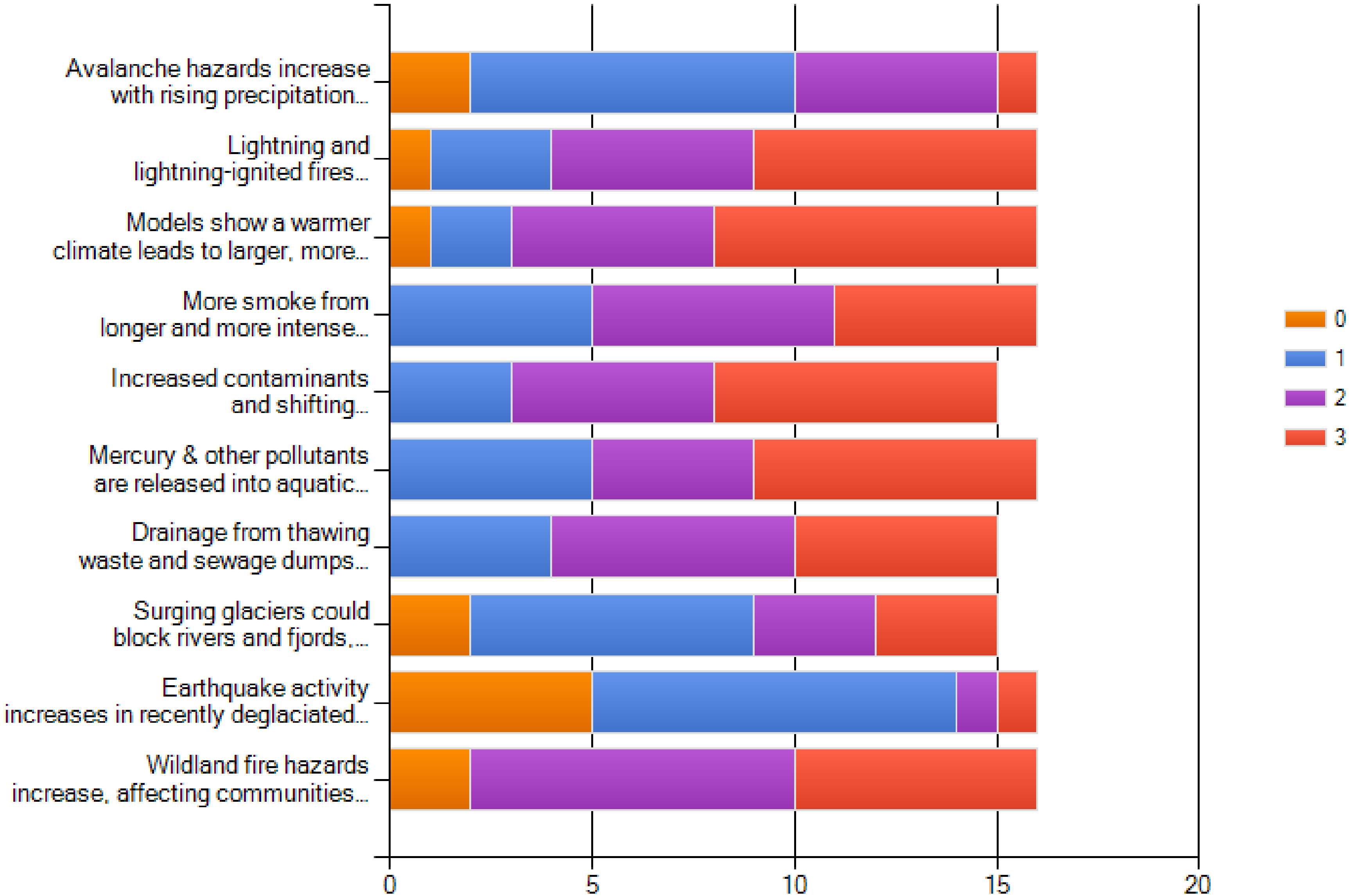
On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on SUBSISTENCE?

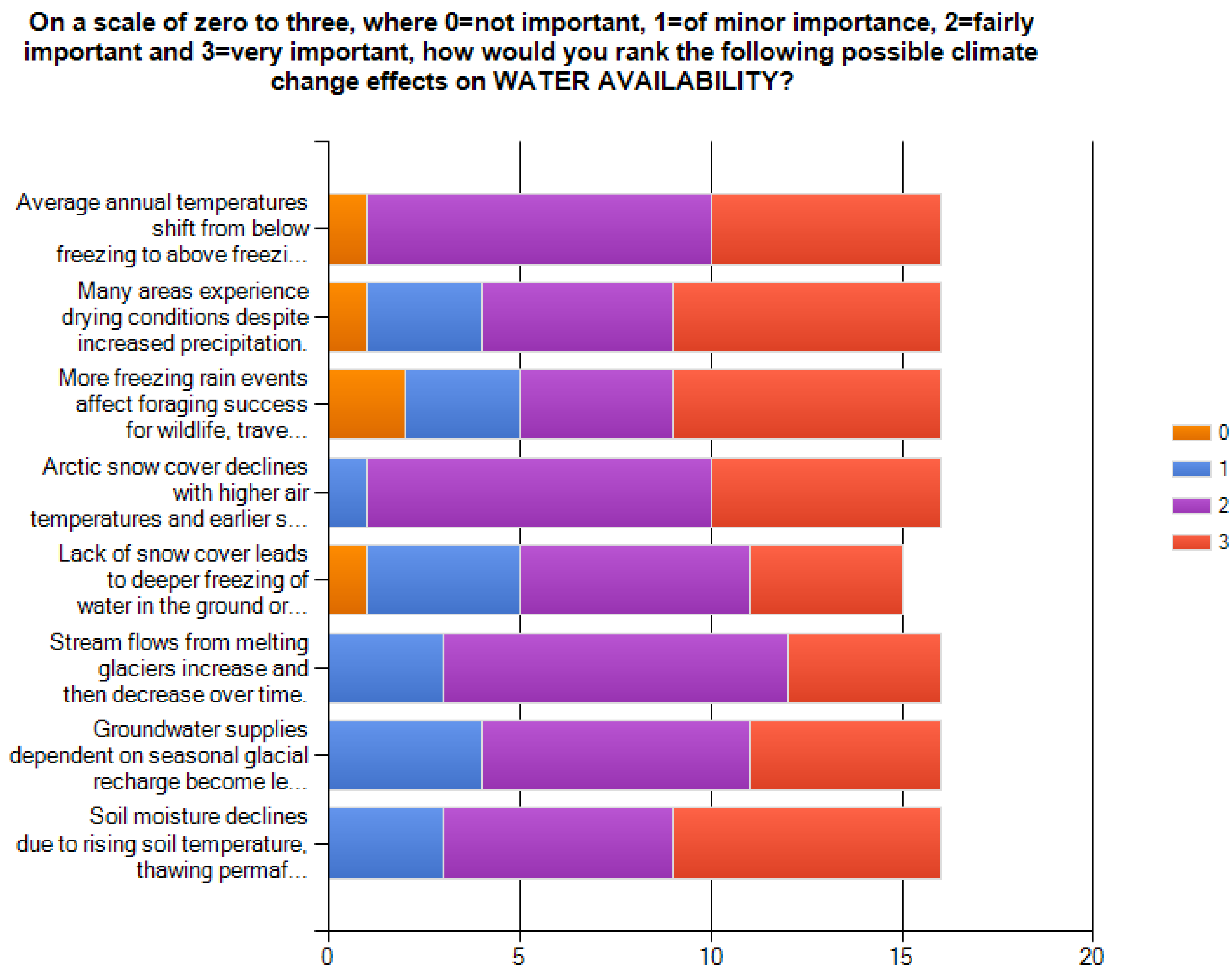


On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on RECREATION?



On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on HUMAN HEALTH AND SAFETY?




On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on WATER AVAILABILITY?
Average annual temperatures shift from below freezing to above freezi...
Many areas experience drying conditions despite increased precipitation.
More freezing rain events affect foraging success for wildlife, trave...
Arctic snow cover declines with higher air temperatures and earlier s...
Lack of snow cover leads to deeper freezing of water in the ground or...
Stream flows from melting glaciers increase and then decrease over time.
Groundwater supplies dependent on seasonal glacial recharge become le...
Soil moisture declines due to rising soil temperature, thawing permaf...
0
5
10
15
20
0
1
2
3

On a scale of zero to three, where 0=not important, 1=of minor importance, 2=fairly important and 3=very important, how would you rank the following possible climate change effects on INFRASTRUCTURE?